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ABSTRACT

The report discusses a program incorporating cognitive therapy with microcomputer technology for head injured students. The goals of cognitive rehabilitation are introduced, the nature and extent of the head injury problem analyzed, and social, emotional, and educational considerations of adolescent head injury illustrated through a case study. The relationship of the computer to cognitive therapy is examined, and advantages of computer applications stressed. The program at a special school for handicapped students is reviewed, its computer components described, and the program's four sectors considered: stress management, retraining of lower level thinking skills, instruction in higher level conceptual skills, and peer support. Software examples used for each component are detailed, and sources of software are discussed (in-house, public domain, commercial). Additional information is provided on peripherals and "typical" sessions. Following case history data, the report examines implementation of such a program within the public schools. A list of software sources and an annotated bibliography conclude the document. (CL)

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# A COMPUTER-BASED CURRICULUM FOR HEAD-INJURED STUDENTS

## INTENDED FOR IMPLEMENTATION IN THE MASSACHUSETTS PUBLIC SCHOOLS

Michael Feer

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COGNITIVE THERAPY REPORT

Contents:


I. Nature, Scope and definition of cognitive rehabilitation.

II. Nature and extent of the head injury problem.

III. Social, emotional and educational considerations of the head-injured.

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VI. The system components utilized for the project.

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Stress Management
Perceptual skills
Conceptual skills
Support group

VIII. Illustrative software examples usedfor each component.

IX. In-depth discussion of software varieties utilized in this project.

In-house
Public Domain
Commercial

X. Peripherals.

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## PROJECT RATIONALE:

Three factors have contributed to the need for such a program in our public schools and the urgency for its implementation.

A. Estimated that more than 100,000 people die annually as a result of head injury. Some 700,000 people annually require extensive hospitalization due directly to head injury, and some 50,000 to 90,000 people suffer intellectual and/or behavioral deficits due to head injury. A high percentage of these numbers involve school-aged children. These numbers will be considered further within this document.

B. Involved individuals and families have not only become more numerous, but more visible through increased awareness of political action and more demanding of services after acute rehabilitation. Consider also that more victims are surviving.

C. Existing programs, finances and services, both privately and publicly supported, are woefully inadequate. The fact is that more and more of the demand for services and monies will focus on the public sector.

Given the higher post-traumatic survival rates, the consequent increased necessity for more effective cognitive and community rehabilitation, and the simultaneous burgeoning of micro-computer technology, it seemed appropriate for cognitive therapists to combine the need with the technology to produce more effective results. As the therapy has mingled with the computer technology in the clinical application, the usefulness and appropriateness of the combination has become more obvious and significant.

The observations and conclusions presented in this report do not represent the introduction of new software designs nor radical approaches to therapeutic protocols. Rather,what is illustrated is a practical and manageable course of action for using existing materials,many in novel ways,for the personalization of cognitive re-training.

The object is to serve as a guide in formulating and implementing an integrated curriculum which can nurture and enhance cognitive growth throughout a student's school/community adjustment. If at all successful,the thoughts presented in the following pages should generate not only the mission noted above, but also the creative re-thinking of educational and therapeutic values with respect to the re-integration of head-injured students.

## APOLOGIA

This report is not in any way intended to provide coverage of the fields of neuro-psychology, counselling and/or cognitive re-habilitation therapy. It is the intent to provide the form for the substance of the report's title - that is a method for public schools to benefit a class of their special ed. students in supplementing the efforts of the above named disciplines.

## I. The nature, scope and definition of cognitive rehabilitation

As a clinical specialty, cognitive therapy is some five to ten years old. Given its youth, it should not be surprising to discover that its practitioners are uncertain about many aspects of the field, even of its primary operational definitions. Yet there do exist some clear and compelling bases upon which recourse to this practice rests.

First, rehabilitation -- that is the training/re-training and re-use for community re-entry of an injured body, not only works but is quite cost-effective and desirable not only for the involved individual but for the wider community as well.

Second, the brain is a part of the body -- not some disassociated wraith -- and as such should be capable of rehabilitation. For much of our social and medical history we have come to associate the word "irreversible" with central nervous system injury. We are coming now to appreciate the great plasticity of response to injury, to healing, and to the various internal and external insults which the brain encounters - and which it can bring to bear to these situations. The brain possesses a capacity to repair reorganize and re-assess itself beyond which we had so certainly assumed. Given this increasingly optimistic trend is it not prudent to address the rehabilitation of the brain as any other body part?

Third, cognition -- the act of knowledge acquisition, integration and mediation -- is known to be a skill, hence capable of

development. It is now rather well accepted that cognition as a process is one with feed-back and redundancy built in and not housed in discrete cerebral centers. The consequence of such a situation is that if a particular brain area is damaged there exists a reasonable possibility for interrupted functioning to be picked up and relearned in other,normally functioning regions. Obviously,back-ups and duplications imply primary operators,so the end-product of rehabilitation may not be at a level as that of pre-trauma -- but certainly closer than previously expected.

The above three beliefs represent the hope and foundation for cognitive therapy. None are written in stone, but taken together they present an optimistic starting point for the re-entry of an injured brain to its home community. There also exists a growing body of clinical and post-clinical evidence that cognitive rehabilitation does indeed work in spite of the 'irreversibility' myths.

GOALS:

As a therapeutic discipline,the goals of cognitive therapy depend entirely upon the presenting condition of the individual client. It is possible,however,to describe two broad ends: the first,to re-train cognitive skills to pre-trauma levels or as close to those levels as possible,and second,in those cases where the deficits will be of long-term to permanent in nature,to train skills in circumvention of and collateral to the deficits as alernative strategies for effective and satisfying coping in the

tasks of daily living.

COGNITIVE SKILLS:

Cognition as a process has already been defined,yet two further points of significance remain to be mentioned. First, cognitive operations must involve awareness,that is conscious manipulation and control at higher thought levels. Second,cognition occurs at many places and levels within the brain,and while function-specific regions do exist,the overwhelming reality is one of holographic representation.

The domain of cognitive skills may be viewed as consisting of two related fields: perceptual and conceptual.

Perceptual skills are those involved in the interpretation of sensory input in the light of previous experience. Perception then deals most directly with the interface of mind to body,stimulus and learning,unconscious and conscious.

One can hear,smell,taste but one perceives when these sensations have been mediated in the wash of past experiences - by memory,attention and discrimination.

Conceptual processes operate entirely within consciousness and integrate the various perceptual modes into the tactics and strategies of social,emotional and behavioral problem solving.

Having established a distinction between perceptive and conceptive operations - it must be quickly noted that no strict demarcations between them exist,for they represent ends of a continuum just as the nervous system structure-function paradigm. Strengths,weaknesses,insults and injuries at one end and level

invariably ripple out and involve the others.

In sum,the perceptual cognitive skills might be tabulated as consisting of the following:

A. Perceptions -

auditory
visual
kinaesthetic
haptic
tactile
olfactory

B. Memories -
short and long term
C. Attention
D. Discrimination
E. Pattern recognition

The conceptual skills may be listed as follows:

A. Logical reasoning
B. Ability to generalise the rules and attributes of experience
C. Problem solving
initiation
definition
organization
planning
resolution
follow-through
D. Novel and creative thought

Examination of the above tables provides the key to the approach and rehabilitation of individual cognitive deficits presented by a head-injured person.

TECHNIQUES OF THERAPY :

In so young a field as cognitive therapy,it would be presumptuous and naive to set forth some particular protocol for there are many and they are in constant formulation and flux. Among the shifting sands,however,lay a set of constants

that are the basis for not only therapy,but cognitive therapy, that is the cognitive therapy most suitable for the brain-injured person.

First, the unique medical and psychological history of the student must be appreciated fully, and the remedial approach tailored appropriately. Second, of critical importance is the realization that thinking skills are precisely that--thinking skills, which are capable of exercise, drill, coaching and development. Third, appreciation of the therapist, trained for the unique needs of the brain-injured is important as he/she becomes a manifestation of patience, support coach, co-hiker of many small steps, audience and cheerleader. Fourth, the student's need to deal with grieving and his loss of support must be realized, and ways of finding and using new support nets must be pursued. And fifth, one must consider the evolving paradigm that advocates the use of micro-computer technology with the learning disabled.

As it is the intent of this project report to clarify the use and potential of computers with the head-injured, the following sections will become more focussed on the fifth paradigm noted above. This specific attention and description will, it is hoped, serve to justify the use of such technology,indicate its necessity, and provide a path sufficiently comfortable to allow public school personnel confidence enough to deal with, accept and benefit their head-injured students.

II. The nature and extent of the head-injury problem:

The initial statement of rationale in justification for this grant study has already noted that each year somewhere between 50,000 and 90,000 individuals will suffer intellectual and behavioral disabilities directly consequent to head injury. Of this number,about two-thirds will be under the age of thirty,and males between the ages of fifteen and twenty-four will have suffered head injury more than any other age group.

Other figures provided by studies of the National Head Injury and Spinal Cord Injury survey of 1980 should suffice to indicate the extent and immediacy of the problem,particularly for educators. The incidence of head injury among males is almost twice that among females. Motor vehicle accidents were the cause of one half of the head injuries. The more severe the injury,the more likely it was to be caused by a vehicular accident. Head injuries occur most frequently on week-ends.

In the early 1970's some 422,000 Americans were hospitalized with head injuries -- 200 out of every 100,000 people. In 1974 the cost to cover only the acute care and rehab for head injuries within the contiguous 48 states was some $2.4 billion ($3.9 billion in 1980).

Little more need be said to indicate the seriousness of the adolescent head injury problem.

III. The social,emotional and educational considerations of adolescent head-injury :

There is perhaps no more compelling nor appropriate form in which to confront this issue than in reviewing an individual's case history.

The student described in the following study is one with whom I have worked intimately. But beyond the strict therapeutic situation,there has been very close involvement with the family and the public school system. This history will serve to illustrate the all-too-often behavioral consequences of head injury as well as the impact upon the person's school administration and personnel. There are some very real lessons to be learned from this case -- enough for all providers to benefit from.

CASE STUDY
Paul Q. (name fictitious)

At the time of his injury,Paul was seventeen years old and just completing his junior year of high school. The cause of injury was an alcohol-related automobile accident.

Paul was comatose for over a month and was being cared for at two hospitals. After one month he was transferred to a third hospital for further care and rehabilitation. While Paul suffered a number of bodily injuries,he also incurred a closed head injury. In his case,the primary brain regions hurt were those below the cerebral cortex;the left thalamus,internal capsule and cerebellum.

Injury to these areas, while sparing much of conscious perception and conception, were to have a significant impact on Paul's mobility, emotions, emotional control, memory and the conscious-unconscious perceptual boundaries.

Paul spent some eight further months in this hospital, awakening from the coma then receiving intensive physical, occupational, psychological therapy and in-hospital schooling via the facility's educational staff.

The following early spring, Paul was released. While completely ambulatory, he suffered from a significant upper body tremor that affected his arm and hand, and his fine manipulation and control. Paul also presented some deficits of memory, most of it was notably with his short-term memory. His speech was slow, labored and whispered, although there were no problems of aphasia. Behaviorally, Paul was easily distracted, quite impulsive, stubborn, easily agitated, frustrated and often aggressive.

Paul is the youngest of five children. He had been working after school at a gas station near home and wanted nothing more than to be an auto mechanic. At school he spent most of his time in a career exploration program that allowed him to work most often in the school's auto shop. He was a healthy muscular adolescent, who, more often than not, settled disputes physically.

Due to a phenomenon known as disinhibition, many of Paul's pre-trauma personality traits that had been inhibited by social and psychological constraints lost those inhibitions and therefore

appeared to have become exaggerated after the injury. Enough so that Paul's aggressiveness not only became more obvious and less controllable,but a new and disturbing center of his personality.

Problems of disinhibition are a normal and predictable set of passages during recovery from head injury,but they can be troublesome - requiring control-training on the patient's part and surveillance and sensitivity on everybody else's.

After Paul had been home for a short time,with the arrangement of the hospital education staff and his home school system,he was allowed to return to school for the final eight weeks of what would have been his senior year of high school. This was accomplished as part of a Chapter 766 diagnostic evaluation.

The school's staff and administration had little to no experience with the head-injured and were more concerned with liability and personal and school safety issues than the education,evaluation and rehabilitation of their student. Paul was required to use a wheel chair in school,even though he did not need it. He was kept isolated from the general student population and dissuaded from going to the auto shop.

The special education administration devoted most of its time and energies in persuading Paul and his family to visit. consider and attend another special ed program rather than trying to adapt his own school system to his needs. At one point Paul's family was notified that he had somehow successfully

completed all requirements for graduation,and he had only to pick up his diploma, and in that act abrogate all chapter 766 responsibilities of his school system at the same time.

After two difficult, often bitter,years of attempting to be served at his own school, and trying other programs for which he was not truly suited (including the Cotting School), Paul and his family finally agreed to accept his diploma. Considering the feelings of all parties at that time, it was probably the most civil, if not the most proper, course of action.

Paul represents a difficult, but not atypical case of a head-injured adolescent attempting the return to home, community and school. For the school system, Paul presented some very real difficulties; first, his tremors did create some safety concerns, particularly in an auto shop; second, his low frustration tolerance and tendency to agitation could make life difficult for all parties concerned; third, Paul was very insistent (disinhibited) about resuming his auto shop training and career track, making it very difficult for the school to place Paul.

Paul could not, without much assistance, help being what he had become. His school system, however, could and did have that obligation and legal responsibility. Ultimately the school system was absolved of responsiblity by wearing the family and student down. The school system felt unprepared and even threatened , having to deal with a case such as Paul's. The truth is that the school system was woefully unready. That unpreparedness is, however, no excuse for absolution, and if the family had had the strength to carry on the

fight - for fight it was - to court,the school district would have had to realize its responsibility in spite of Paul being a hard case. The school in both its attitude and actions did in no way assist Paul in his re-entry and recovery,and very probably made his agitation and control problems more manifest by increasing his experiences of frustration.

BEHAVIOURAL ALTERATIONS SUBSEQUENT TO HEAD INJURY :

While each instance of closed head injury is,in fact unique,there does exist a set of neuro-behavioral symptoms which often follow from the injury and subsequent recuperation of the individual. A number of these alterations are demonstrated in Paul's case and are indeed troublesome to the child,the family,friends and other service providers. It should be borne in mind,however,that depending upon the depth and breadth of tissue damage,many of these changes are not only predictable and transitory,but also are indicative of progress in recovery. These neuro-behavioural manifestations,even if long-lasting,can be managed in a number of ways and can be dealt with satisfactorily.

A Tabular Summary of some character changes:

a. Disinhibition(many of the personal and social inhibitions to certain behaviors are lowered) - allowing for:
   - low frustration tolerance
   - easy distractibility
   - impulsive behavior
   - aggressive behavior
   - hyper-sexed behavior

b. Agitation

c. Memory problems

d. Time and space orientation problems

e. Depression - due to sudden change in life-style,self-perception,loss of peer supports. A 'grieving' response to the,literal,loss of the old self.

f. A variety of cognitive deficits,depending upon sites and degrees of neural damage and loss.

It should be obvious that cognitive therapy,as operant in this report,cannot address itself to all of these issues,nor

should it. Yet the process of cognitive therapy can be a significant and positive influence on these associated behavioral symptoms. And the methods of cognitive therapy,with particular respect to computer usage,are most amenable to the school situation and can be of great assistance to school personnel who are responsible for care provision,training,sensitization and consultation.

## IV. The relationship of the computer to cognitive therapy.

The appearance of both cognitive therapy and the available micro-computer have occurred in a series of independent and parallel developments. It is this, largely chance, evolution that has brought the two together. For in the search for an appropriate therapeutic mode, cognitive therapists have discovered in the personal computer a uniquely qualified, adaptable and serviceable tool. It is NOT that cognitive therapy could not be accomplished without the computer, for it surely could with the older technologies. Rather, the computer enhances the therapy, making it more real, controllable, specific and truly internalized.

Most educational and therapeutic ends could be accomplished with desk top, paper and pencil activities,and almost all high claims for computer use can be answered and matched by more traditional teaching and clinical means. BUT...there are some which cannot, and these are vital to the efforts of the cognitive therapist and to the recovering brain.

In five years of clinical computer use with physically disabled/learning disabled adolescents, I have discovered three reasons for going high-tech with computers--three reasons that cannot be broached or denigrated by the claims of faddishness, expense, redundancy, etc.

The first is the most practical and explicable; the computer is ever so much more adaptable and accessible to the disabled person. For whatever the level of disability,the computer can be adapted to the user more easily than any other educational device or system.

The second goes directly to the head-injured's distractibility, lack of concentration, poor organization, and memory deficits. Individuals with such global problems can be, and often are, overwhelmed by the teems of details that surround a question and its eventual answer. Just arranging for materials like pencils and papers, writing and erasing, turning pages and throwing scraps away can be too frustrating to the learning disabled. Add to this list all the important steps in attacking a question--all the important normal problem solving strategies, ancillary to the problem definition-solution itself. For how often does it happen that the poor reader will not read because there appears to be too many pages, or they are too big, or the type is too small. The very same associated, but not central,issues serve to frustrate thinking.

The computer can be programmed to present a problem clearly--one clear step proceeding to the next. The essential line of reasoning is always clear and can be made visible at any time. Mistakes can be retained or made to disappear at will.

Without the mass of side issues, data and manipulatives to screen and sieve of the central question, the learning disabled becomes capable of generating movement, and movement generates more movement, experimentation and progress. And progress occurs along a controlled ( and many head-injured students need a feeling of being bounded and helped to be in control), calm, highly visible and relatively narrow path.

This second reason for computer use I feel cannot be overestimated and represents order-of-magnitude in difference to any other educational therapeutic application.

The third, which MAY not be the most significant, but certainly the most compelling, must be characterized as the "great unanswered" reason. That is that much computer activity, particularly gaming, is not only highly motivating, but downright addictive. The unanswered paradox is that the most motivating and addictive activities are precisely those which guarantee failure to the user.

In almost all arcade-style games and cognitively-based therapeutic activities with the computer, challenges are hurled which,no matter how good the player is, will ultimately defeat him. Level upon level is built, difficulty and tension mount, yet the student-player-client-patient plays on, and on. There may be no hope of winning, or of even getting close, yet he plays on with the same level of addiction and competition that the "normal" player musters.

It is this very level of intensity that is achieved with computer gaming, simulation and other activities, which cannot be matched by any other mode. Why does this happen in the face of frustration that would crush any further involvement? I can only vaguely guess, but I am fully intent on taking advantage of it for the progress it offers my kids.

The three reasons cited above I feel more than justify the unique place of the computer in cognitive therapy. Beyond these, however, lie a host of traits the computer offers to both the clinician and teacher. Most significant among these are the fact that computer use requires interaction. Unlike a film or TV or tapes, the computer requires that the user be precisely that--a user, and be in mental and physical interaction with the device.

The computer can be made to interact with and learn from the user, to teach the user and to play with the user. This last attribute cannot be undervalued.

Much of the remainder of this report will serve to detail the uses to which the micro-computer has been put at the service of the cognitive retraining of the head-injured adolescent. It is hoped that such detailed analysis and history will provide a route and mechanism whereby the community public schools will be able and willing to implement remediation programs with their head-injured students.

## V. Computer-based cognitive rehabilitation at the Cotting School.

Computers have been an integral part of the Cotting curriculum since the mid-1970's when they were introduced concurrently with the MIT Logo pilot project. Although the project originally targeted middle and upper school students at the School, Logo and computers have spread throughout Cotting to occupy virtually every classroom from primary through post-graduate.

In 1980 I became involved in teaching Logo and computers to the Cotting ninth graders. This afforded me the opportunity to do a good deal of informal assessing of various cognitive styles with the computer as instrument. A broad search then began for application programs which might help remediate particular academic and learning deficits among our students, with little success.

In 1982, as the coordinator of the upper school resource room, I began to use the computer more intensively as a one-to-one remedial tool and searched more intensively for both hardware and software which might assist in the training/retraining of conceptual skills.

It was about this time that contact was made with Dr. Gabor Laufer, a Virginia obstetrician who had a three year old cerebral palsied child and an interest in computers. In attempting to assess the capabilities of his child and train skills, he developed his learning room programs. Dr. Laufer kindly shared his programs with me, and I began using them with students at Cotting.

Several programs were then developed with the assistance of an MIT programmer written in Logo. While these programs were suitable for many problems and are still in use, they were essentially directed to the development of perceptual skills. The quest continued for programs that might assist the conceptual levels.

Since 1982, more and more time has been devoted to direct cognitive retraining with students presenting a wide variety of developmental disabilities with the computer as the primary tool. In that time quite literally hundreds of programs have been investigated, adapted and used with the disabled student. Enough familiarity has been gained with the computer to sense its power to assist rehabilitation and to frustrate that assistance when used incorrectly.

For at the very basis it must be born constantly in mind that the computer is a tool, not an end. As such it must be used with care, sensitivity and adequate preparation. The therapeutic computer is a member of a tightly defined triad--the tutor, the student and the computer. Each is intimately involved in the process of growth and change, and yes, the computer can take on a life of its own in relation to the user.

During this past year, due in large measure to the support of the grant award from the Department of Education, it has become possible to further explore the relationship of the computer to cognitive rehabilitation and to refine its use, presentation and integration into a school setting.

Another significant development flowing from this grant support has been the focussing of such a program on the needs of the post-traumatically head-injured student. It is to these students and their fuller integration into their home communities that this report is dedicated with the fervent hope that such rehabilitative programs could be instituted in local public schools.

Cotting School's involvement with such therapeutic activities has been consistent and on-going with the certain aim of this being continued and encouraged.

## VI. The computer system components utilized for this program.

All references in this report to computer hardware, software and firmware are directed in essence to the Apple II line of computers and their compatible peripherals.

The direct work with students has been done with an Apple IIe computer with an extended 80 column card, two disk drives, a 12 inch diagonal Sanyo color monitor and an Epson MX80 printer.

Additional peripherals used and felt to be essential are a Kraft spring-centered joy stick, paddles,and as alternate key boards, a Koala Pad and a Presfax100 programmeable Key Pad. The Adaptive Firmware Card should also be considered an essential component of the system.

In addition to these, comfortable chairs must be provided. An adjustable computer table is necessary not only for comfort, but for wheel chair access. A place which will assure some privacy is also essential.

Disability adaptations should be as invisible and noninvasive as possible and used only when absolutely necessary as the goal is independence.

Specific considerations of all the equipment mentioned above will be given in the detailed discussions that follow.

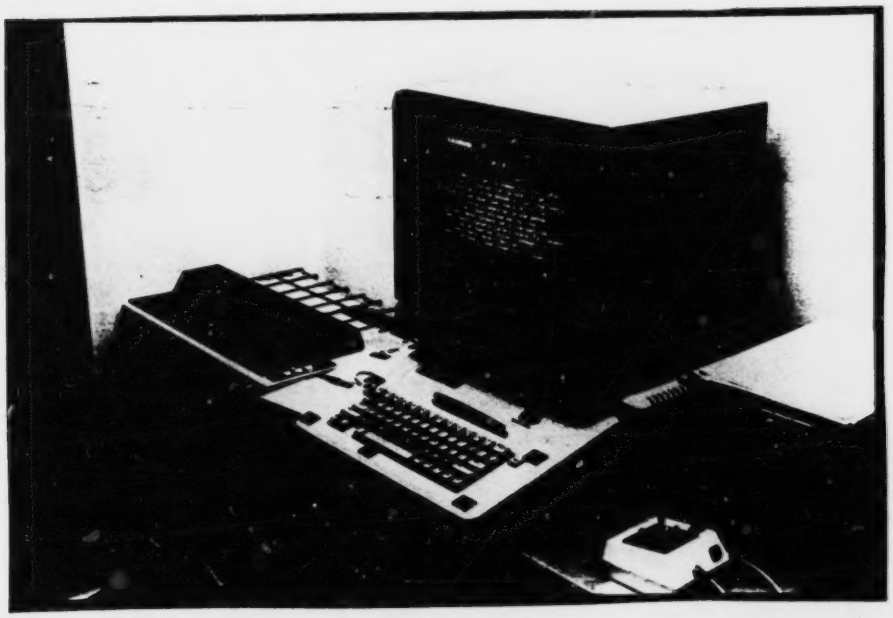

Fig. 1 Micro-computer equipment and set up.

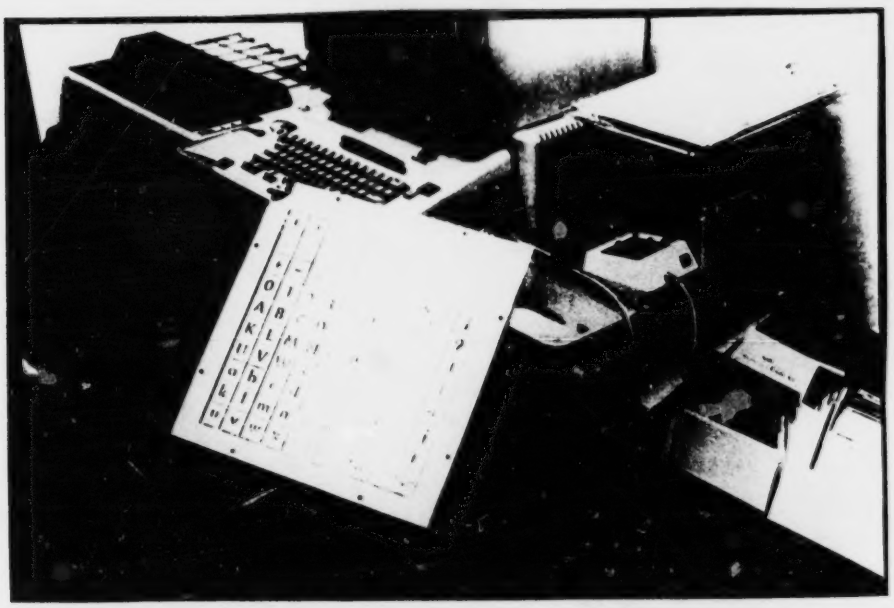

Fig.2 Connection of alternate keyboard with external gameport (Presfax shown).



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## The "program"

Every student,no matter what his history, encounters the following:

Each comes with a medical history and a neuropsychological evaluation along with any other relevant history.

Each enters a variable period of acquaintance and mutual adaptations to the computer with respect to motoric and cognitive functioning and to baseline establishing.

Each proceed with an individualized program integrating the four components of the therapeutic path: stress management, perceptual skills, conceptual skills and group work. These activities are combined around the weekly schedule, intermingled within sessions and presented as needed.

Each has a session log maintained by the therapist.

Each maintains a personal session journal on disk.

Each maintains a file of data disks as appropriate to programs being used.

Each is helped to recognize that a primary goal is to advance from receiving more cures during activities to fewer cues.

Each is helped to realize the movement from skill-specific activities to more associative, integrated skill activities.

Each is encouraged to recognize the importance of each activity to dealing with real world situations. This last point cannot be stressed enough, particularly for adolescents who are very sensitive to condescension, "game" playing and "busy work" activities.

## VII. Program Structure.

The program moves among four sectors with the flexibility to suit the needs of each case and the exigencies of each during the course of work.

The first sector is that of stress management. Life changes are stressful events, and sudden, unexpected changes that involve uncontrolled loss are that much more stressful. In a very real sense the person recovering from traumatic head injury passes through a greiving process identical to that experienced after the death of a loved one.

The instant of injury creates a new person, who being newborn, must relearn the cognitive skills, must re-adapt to social situations, and must resolve their own death and rebirth. On top of all these requirements, the person must adapt and retrain much of his/her physical skills. To say that this process invokes stress is an understatement in the extreme.

Much is being learned about stress--its causes, mechanisms, and consequences. One certainty is that its emotional component is but one aspect of a broad constellation of physical and mental insult.

Cognitive recovery from head injury simply will not occur well, if at all, without addressing the pressing issue of stress control. While this may seem an issue to be worked on by conselling therapy, a computer-based program using cognitive and biofeedback skills can greatly help to manage stress, reinforce the recognition of connection between thinking

and the body, and make cognitive retraining much more likely.

This process is not a difficult, time consuming or arcane one. As will be seen from the description of programs in the next section, it can be fun, educational and very therapeutic.

The second sector consists of the retraining of lower level thinking skills, which have been previously denoted as perceptual. The perceptual deficits following head injury are usually the most frustrating to the person because they are the most obvious and ever-present barbs, constantly reminding the person of the injury.

For no good reason the person neglects a side of the body, forgets what day it is, cannot form words,can only pay attention for a few seconds, goes into a rage, sees gibberish or hears gibberish or experiences all of these conditions!

The person's past is of little or no help in interpreting the present flurry of incoming messages. There is great confusion about so many simple and natural things. These are perceptual deficits upon which the higher cognitive skills depend. A person might not even know that he/she cannot solve problems anymore, but they certainly know that they must be told repeatedly what day it is.

The third sector is directed to those higher level thinking skills referred to as conceptual. In essence the conceptual skills center about a person's ability to attack a problem. Can the person define the problem, note its variables, organize an approach, mount and sustain the attack, solve the problem and follow through with satisfactory and satisfying resolutions.

These are not a simple set of skills. These are perhaps not as obvious and as nettlesome as perceptual problems, but they are no less essential to real-life functioning.

Skill in these two cognitive domains is highly integrated and mutually supportive. A person with poor impulse control or one who is quite perseverative will have great difficulty in initiating and/or sustaining an attack of a problem, from deciding what color to choose next to deciding what to do if he misses a bus. So directive therapy for each, while specific and distinct, must always be related and made obvious to the student.

The fourth sector is that of support, that is, essentially peer support--peers who have been head-injured as well as able-bodied peers. The school setting is ideal for the organization of such a support network.

Obviously, recovery does not occur in a mental and social vacuum. Feelings must be share. This in itself is a problem solving strategy. Again, the computer can be of service in group work in a number of educational and entertaining ways, ways which can ease the flow and direction of feelings, movement and recovery.

The above descriptions then represent the four wedges cut apart and fitted together to form and re-form the pie baked in this program of cognitive therapy. It remains now to specifically describe how each is practiced in the cognitive therapy program at the Cotting School.

```
CALMPUTE - (C) 1984 THOUGHT TECH.

PRESS

   1 - INSTRUCTIONS
   2 - INTRO TO BIOFEEDBACK
   3 - PHYSICAL STRESS TEST
   4 - PSYCHOLOGICAL STRESS TEST
   5 - RELAXATION/STRESS MANAGEMENT
   6 - CALM-SCOPE
   7 - CALM-BAR
   8 - CALM-PRIX

WHICH : [ ]
```

Fig. 3a Calmpute menu.

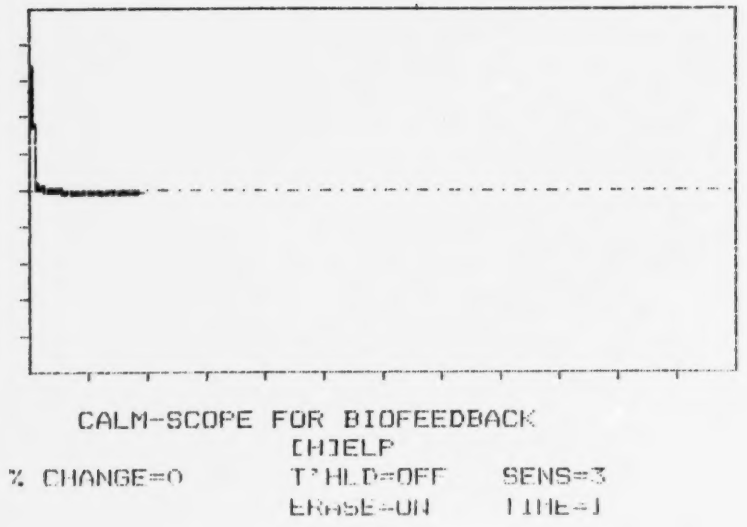


Fig. 3b Calmpute...Calmscope chart option.



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Calm-pute enables the user to take some interactive tests that display alterations in stress levels as the questions and activities proceed. Relax presents a kaleidoscope of colors and patterns which alter with varying stress levels; this is rather confusing and at times annoying.

Both programs also present games that require control of stress and relaxation states in order to be played successfully.

Relax present much better graphics and greater sensitivity to body states. The game one plays in the Relax package is also much more easily understood and accomplished. It is more involving and more clearly related to the user's stress level than Calm-pute.

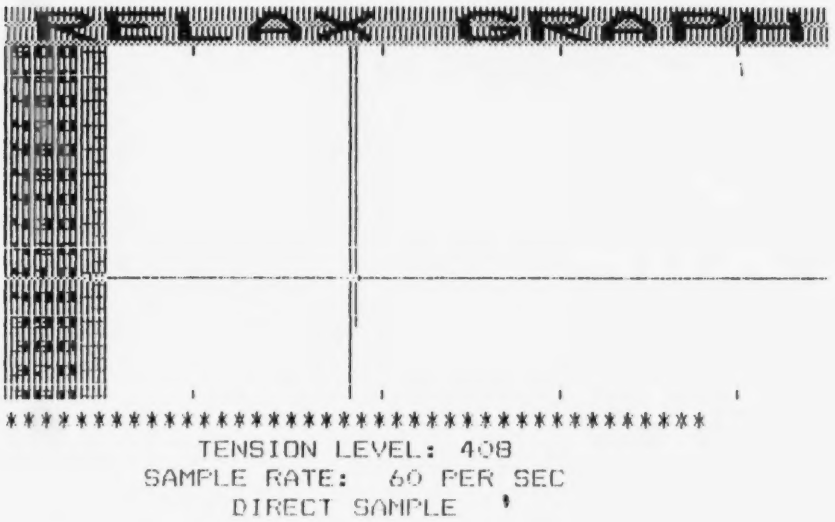


Fig. 4 Relax graph.

While Calm-pute is technically the better program, allowing for more controlled and interactive options and even the saving of one of the stress test results, Relax is the preferred choice for working on bio-feedback with students.



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## VIII. Software examples for each program sector.

In this section, the four remedial sectors will be addressed, and selected examples of computer programs that have been used will be described. Further examples will be detailed under separate sections to follow.

A. Stress management--

Two computer-based, biofeedback and relaxation programs are most applicable at this point. Calm-pute, produced by Thought Technology, Inc. in Canada, and Relax, created by Synapse Software of Richmond, California. Calm-pute depends upon the galvanic skin response of the user and a transducer to input that data to the computer. Relax utilizes electromyographic data from a head band fed back to the computer.

Calm-pute costs approximately ninety dollars and Relax costs about one hundred and forty dollars. Both allow the user to follow their feedback data on scrolling graphs, neither of which (unfortunately) can be saved to disk. Both transducers plug into the game input/output port of the Apple II; the Relax interface, being a universal one, is somewhat more clumsy.

These programs have been used with every student seen in this project. The results have been universally positive and have allowed each user to realize two things; that he/she is capable of controlled relaxation responses to stress, and that the mind is indeed capable of exercising control over bodily responses. These are both powerful and empowering facts, essential to cognitive retraining.

Levels of relaxation achieved and carried over beyond the session varied widely, from slight calming and more even breathing to deep hypnosis and high suggestibility. Several students noted their use of the relaxation techniques at Home. One student was able to use the methods to control tremor.

B. Lower level cognitive skills:

Many, many programs have been used in this project for the training of specific and general perceptual skills. The exemplar to be cited here has been selected for it easy availability, moderate cost, effectiveness and high interest. The program is a commercial arcade-style game called Skyfox. It is published by Electronic Arts of San Mateo, California and costs approximately forty dollars.

The game's premise is that the user is a pilot responsible for destroying varying numbers of enemy tanks, planes and invading mother ships. The user has a cockpit's view of the battles. Skyfox comes with a number of different scenarios and five different levels of skill. The better one becomes, the more challenging the demands made until the plane seems to be shot down by the enemy almost as soon as it takes off. Highly frustrating, yet plainly addictive.

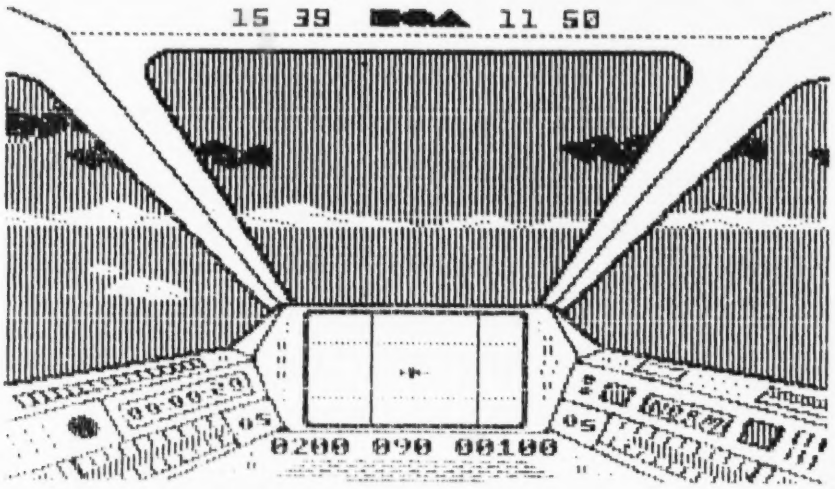


Fig. 5 Skyfox, pilot's view.

Control over the game is exerted by both the keyboard and the joy-stick. The pilot must fly about pursuing the enemy, controlling speed and altitude, firing, turning and avoiding enemy fire.

The perceptual skills selected for this activity are the ability to attend, visual tracking, visuo-motor and sensori-motor skills, short-term memory required for the placement of forces, and long-term memory required for the knowledge of keyboard commands and the instrument panel.

It is true that a program like Skyfox cannot selectively isolate, test and train a specific perceptual unit. There is much software available for that purpose. It must be kept in mind though that perception is an integrative function, and while there may be specific defects, these do not operate in isolation. Their retraining must focus on re-integration. It does no good to isolate the triceps in order to increase upper arm strength.



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Skyfox worked most effectively with one student who, while still in recovery from head injury, suffered a severe seizure during the course of the school year. The seizure put this student back perceptually to almost the point where he had been upon his release from hospital. Anti-seizure medication lowered his responsivity and motivations significantly.

At this point the aim of cognitive therapy was simply to maintain him and attempt to get him back to pre-seizure functioning. He had not played Skyfox before, but saw one of the other kids playing it and asked if he could try. It was obviously terribly frustrating from him toplay having to remember with great difficulty what to do and when to do it. He was constantly being shot down before he could maneuver. For weeks he played nothing but Skyfox and was very slowly getting better at it.

As time passed and he came off the medication and gained more control over his reactions, associations and perceptions, he gradually withdrew himself from Skyfox. The need for challenge and the need to feel "normal" by doing normal youth activities was no longer as insistent. Skyfox allowed him to maintain and hold together while barely functioning in a way not seen as "clinical." While the game was certainly threatening and frustrating, it was not a threat in the "therapeutic" sense. Skyfox accomplished every clinical perceptual goal asked of it, and the client weaned himself of it.

C. High level cognitive skills:

Again, there are a number of good programs available serving this function, which will be noted and discussed at a later point. Simplicity and directness will best be served by considering a fairly simple public domain program called Peggy. While representative

of a fairly ancient line of games, Peggy was programmed by Stuart Anstis in Applesoft basic. Both games and program are fairly simple. One begins with a board on which is a triangle of fifteen pegs. The player begins by selecting a peg to remove. From then on, he must remove pegs only by jumping over an adjacent peg to an empty spot. The object of the game is to finish with as few pegs left on the board as possible.

Fig. 6 Lo-res graphics set up of the Peggy game board.

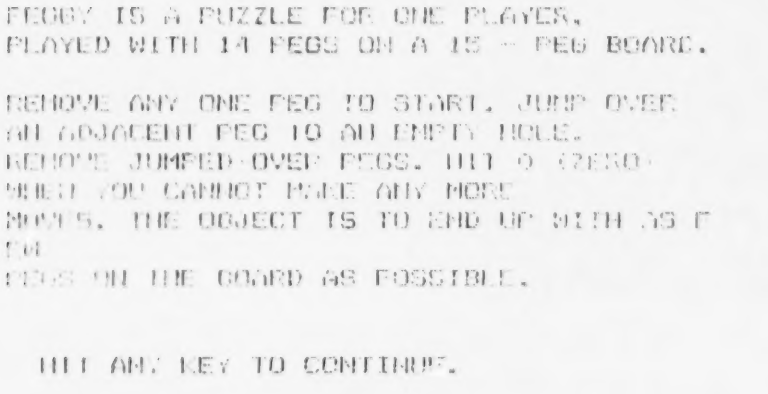
PEGGY IS A PUZZLE FOR ONE PLAYER,
PLAYED WITH 14 PEGS ON A 15 - PEG BOARD.
REMOVE ANY ONE PEG TO START. JUMP OVER
AN ADJACENT PEG TO AN EMPTY HOLE.
REMOVE JUMPED-OVER PEGS. HIT 0 (ZERO)
WHEN YOU CANNOT MAKE ANY MORE
MOVES. THE OBJECT IS TO END UP WITH AS F
EW
PEGS ON THE BOARD AS POSSIBLE.
HIT ANY KEY TO CONTINUE.

Fig. 7 On-screen instructions for Peggy.

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The program has been presented to almost every student involved in this project with widely varying reactions largely dependent upon their conceptual deficits. When the game has been presented, it has been done so with no introduction. The student can decide whether or not to read the directions. As impulsivity characterizes many of these kids, a number have not bothered with directions, to their consternation, for little assistance is offered by the tutor. Once the directions are read, they must be understood and put into operation. The first decision involves the choice of which peg to remove. This is not an easy thing to do for a person who has trouble making decisions. Once the initial steps have been taken, it does not take long for a mastery of the rules of the game to develop. Mastery of the game's object is a different matter.

So far this is all rather straightforward. The real conceptual use of the simple game Peggy comes when, after mastery, the student is asked to state the rules governing Peggy. He/she is simply requested to tell someone else unaquainted with Peggy how to play. After that the student is asked to write the rules down, using a word processor, the Bank Street Writer.

The accomplishment of the above goals requires the effective workout of a host of conceptual cognitive skills. The person must understand rules and attributes, problem definition, sequence, organization and communication.

The Peggy exercises were most useful and applicable to a student who can deal with and remember facts but but is unable to put them together to form a coherent whole or approach. It took one boy two rather frustrating sessions to master Peggy's rules. After mastery, he could play easily, but could not explain with any coherence how until he had had much more work with the game and its fairly simple structures.

D. Support group:

While a support discussion group is essential, it is difficult and even unwise to talk all of the time directly about issues of head injury. There are other areas of address, notably group cooperation, problem definition, attack and resolution.

A most useful computer program for this purpose has been Project Planner produced by Applitech Software of Cambridge, Mass. Project Planner, which will be described fully below, allowed students to cooperatively approach and organize several real-life projects., such as a raffle and a class trip. Group members also worked on organizing a party with each one responsible for generating activities essential for a particular aspect of the party. One worked on food, another on entertainment, another on the setting, etc. All this information was then gathered and fed into the computer for final configuration and scheduling.

It must be kept firmly in mind that the preceding examples of software application are just that--examples. They have been successful, but each could probably be replaced by another example and certainly will be as the state-of-the-art progresses. Other programs and applications will be considered below from a variety of perspectives and finally from the perspective of the student.

## IX. Forms of software used:

In considering the variety of software packages used during the period of this project, it would seem most convenient to divide them into three categories: individually produced in-house material, public domain software, and commercially available programs. the commercially available materials can be subdivided into those packages specifically designed for remediation-education and those designed for recreational-business utility.

### In-house:

The first independent program was created and then programmed in the Terrapin Logo language. It consists of a group of some six activities requiring the use of perceptual skills as visual discrimination and memory. The activities are sequenced in that fewer cues are provided to the student as the activities proceed.

While these programs have been effective for perceptual retraining, their major weakness is that they were written in Logo. In order to use them, Logo must first be booted into the system before inserting the disk. This is only a nuisance, but can be significant in deciding what software to use with a student.

The second variety of software generated for cognitive therapy at Cotting School utilizes the Apple Pilot language. Apple Pilot is an authoring system specifically created for the design of computer-aided instruction modules (CAI).

As of this writing two modules have been composed using Pilot. While they are both quite simple, they represent a segment of a much broader package of activities. Each disk presents the user with a brief explanation followed by a series of from eight to ten designs. Each design is shown for ten seconds and then the screen is cleared. When the user is ready, the space bar is pressed and the next figure is shown. The first disk presents very simple figures, the second, slightly more complex ones.

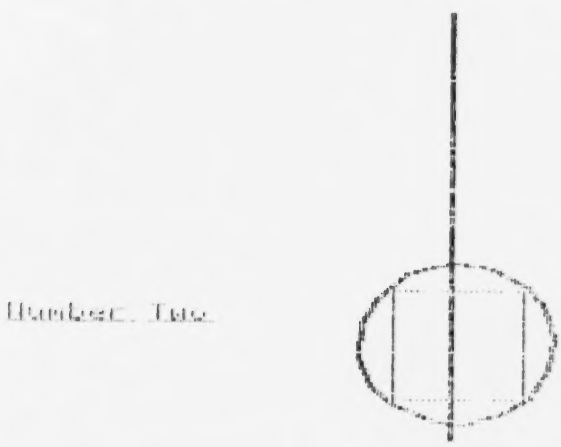


Fig. 9 Figure presentation in the Pilot produced memory lessons.

The student's responsibility is to observe the figure, then after it has disappeared write a long-hand description of the illustration. He is told to describe it well enough to invoke it clear in memory at a later time. The student writes his description in a notebook specifically provided for these exercises.

At some later point the student receives the notebook. He is asked to read his descriptions of one or two pictures so far seen and to recreate the original figure on the computer using the Koala Pad to enter his reproduction. The completed replica is then saved to disk so that it can be compared to the original figure on the Pilot disk.

This rather simple program initiates a series of cognitve actions which must be exercised and integrated to ultimately complete the task, which could well take several weeks. The person must observe the figure, remember it, and be able to write a meaningful description of it. He must exercise long-term memory to restore the picture on rereading the description, be able to visualize it, and use the computer in another fashion to input data with the Koala Pad. The greater the number of cognitive skills required for completion, the more effective, long lasting and internalized the retraining.

Another activity using Apple Pilot is being worked on. When completed it will present a lesson and activities about flow charting as a way of defining and solving problems.

The third series of independent activities constructed for cognitive retraining during this project have utilized an alternative keyboard, Presfax.

The Presfax is a touch-sensitive board divided into one hundred one-inch squares. The board interfaces the computer via the game I/O port. The Presfax comes with its own software and several applications examples. As a touch-sensitive board, Presfax is identical to the Koala Pad exept that it is fully

programmable and comes with two software-supplied programming options, which make the board quite unique.

The first, Askfax, allows one to create any set of questions that one reads on the terminal screen and answers by pressing the correct locality on the keyboard. The answer is followed by a statement on the screen.

The second application, Getfax, allows one to configure the board as a data base. In this mode, each square or set of squares can be programmed as a distinct data base, providing that information when the pad is pressed in response to an on-screen query.

Perhaps one of the most useful programs designed for Askfax for the project at Cotting is Citystreets. An overlay of a number of city blocks with several landmarks and a compass rose was drawn to fit over the Presfax keyboard. A number of questions were then composed for on-screen display to guide the user. The student, in response to the questions, must follow a sequence of navigational steps around the city. If he makes an incorrect move by pressing the wrong spot, the screen will inform him and will provide supportive feedback when the correct move is made.

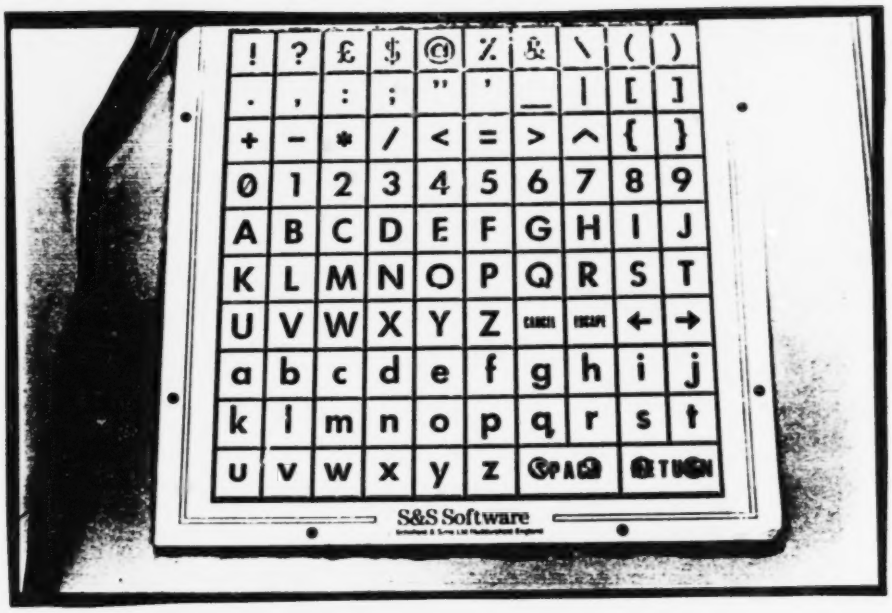
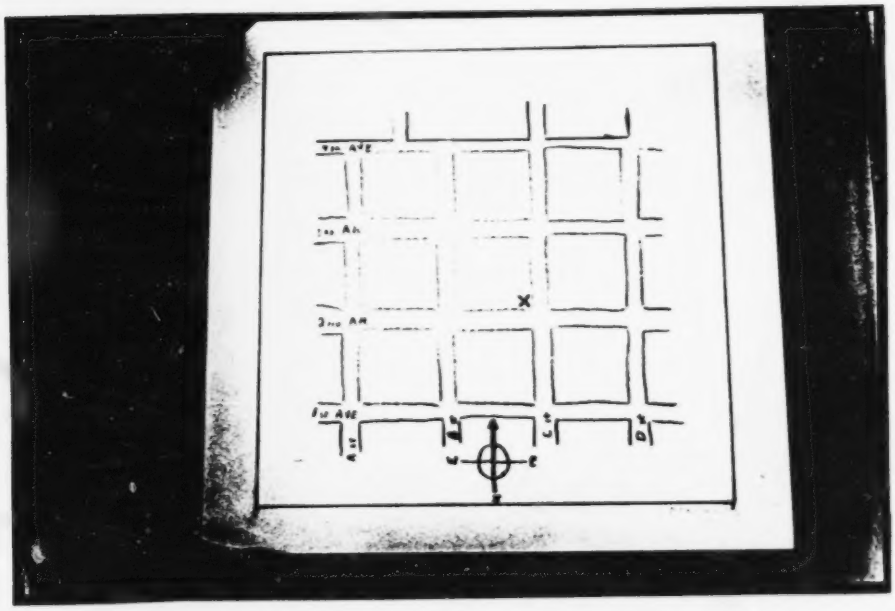



Fig. 10 Presfax board with alpha-numeric overlay.

Fig. 11 Presfax with Citystreets overlay.





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Several key cognitive skills are being dealt with in this activity, most of which center around spatial perceptions, directionality and laterality.

A few Askfax overlay activities have been written concerning the understanding of rules governing relationships. The student is presented with graphic figures, several of which demonstrate rules of association. He is then asked to indicate an understanding of the association by selecting by touch those figures expressing the rule.

A final Askfax activity, one specifically written for a student, consists of an overlay presenting an illustration of an auto chassis and some diagrammed blow-up of various engine parts. The student Paul,noted in the preceding case study, possessed an avid interest in auto mechanics, so it was natural for some of his cognitive memory and thinking retraining to take advantage of this area.

The Getfax programs written for use in this project have focussed on the teaching of word recognition by word shape or configuration. A series of overlays have been drawn showing a number of word configurations. The corresponding grid blocks have been redefined to together contain a list of printed words that conform to the configuration. When the pad is pressed, the screen displays that listing. In one activity, such as concentration, a configuration is shown and the student presses a block (at random first). On the screen a list of words that may or may not correspond to the configuration is shown. The student must remember the words and block, for he is then shown another configuration and must try to find it and match the other configuartions with their grid-mates.

Public Domain Software:

Software placed in the public domain are generally of three types: packages developed by educational groups and distributed without restriction to any users; programs developed by computer interest groups for their own use, then distributed to other groups; and third, programs that have been developed by individuals for their unique purpose and subsequently made available for other computer users without copyright restrictions. Many older, proprietary programs have also found their way into the public domain.

With such a wide source for development, the quality of public domain software (PDS) ranges widely from exeptionally good to unusable trash. There is much PDS available for little to no cost. Assess to this software normally comes with membership in the many computer societies around the country, for each normally maintains a library of PDS available at minimal cost.

Within the more scholastic sphere,the Educational Computing Network in Riverside, California publishes and distributes PDS, some of which has been of good use in this cognitive therapy project.

This author is also a memeber of the Boston Computer Society, Washington Apple Pi out of Washington, D.C., and the International Apple Core, which publishes a PDS disk each month of programs gathered from individuals and user-groups around the world.

When one obtains a disk of PDS, one never knows its value or utility beforehand. Some programs will not run, some are simply awful, and others are gems (accidentally discovered) to be treasured forever. Therefore, where does one begin a discussion of PDS programs used for cognitive therapy?

It may be most satisfying and encouraging to others to begin by describing three programs discovered on a Boston Computer Society, Apple group disk. Three on one disk are highly unusual, but they are all excellent, and one is a true gem.

The original source of the disk is the Tulsa Computer Society. The two useful programs on the disk are strategy games, Awari and Othello. Othello has appeared in many forms in PDS, but this particular version, adapted by Charles Hearn, is well-suited for the learning disabled. It is graphically, large and simple and is easily controlled from the keyboard. The rules for both games are easily mastered, yet each offers subtlety of play that is demanding and engaging.

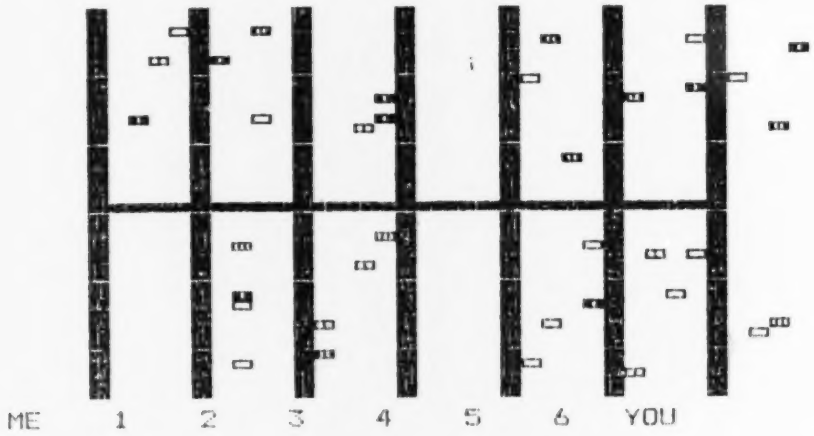


Fig. 12 Game of Awari.



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The gem is a program entitled Decision, originally created by Gordon Stallings. Decision is a fairly simple, yet elegant, user-friendly and well designed decision aid. The program operates by requesting the user to assign numeric rankings to a listed set of courses of action, then rankings to a set of factors that that will influence each course of action. The program then operates on the assigned variables and produces arithmetic scored for each action listed. The scores indicate the preferred alternative. The program allows one to alter the listings and rankings at any time and also allows one to save data and results to a separate data disk.

The Decision user can input data in two forms, either as a list of items to be chosen from,or a list of alternative courses of action. Decision is presented as all text and in a very basic, straightforward manner. Therefore, it is very important for the tutor to be guiding and probing this activity closely with the student. The true value of Decision lies not only in the clear organization it forces, but in the thought it requires for each alternative and factor in assigning ranks.

An example of how Decision was used with a particular student follows. The student was given the scenario that he arrived home to find that no one was there. The door was locked and he had no key. What might he do? He had to generate a list of alternative action, from breaking the door down to waiting, and then the factors that might influence each alternative.

While not thrilled with doing Decision, students have found it to be an invaluable exercise in open-ended, real-life problem solving.

Another disk that has proved quite useful, also obtained via the Apple users group of the Boston Computer Society, is called the Electronic Arcade. It is composed of a series of games created by a group of Japanese Apple computer users. If the fractured English can be excused, one can see the significant cognitive value of one particular game, which has been met with enthusiasm by the students.

The game is called the Hi-Res Dragon Maze. In it a rather complex maze is drawn at random by the computer. The player should attempt to memorize the larger landmarks of the maze, for upon completion, it disappears. At this point, the player is placed at some random point at one end of the maze. An opening appears at the other. He must now navigate his way to the entrance by up, down, left, right commands trying to avoid not only hitting the walls, which become visible only upon beign hit, but also encountering a monster guarding the opening, who moves closer with each movement of the player. The dragon maze is an excellent exercise in visual perception, strategic thinking, and memory.

Fig. 13 The Hi-res Dragon Maze.



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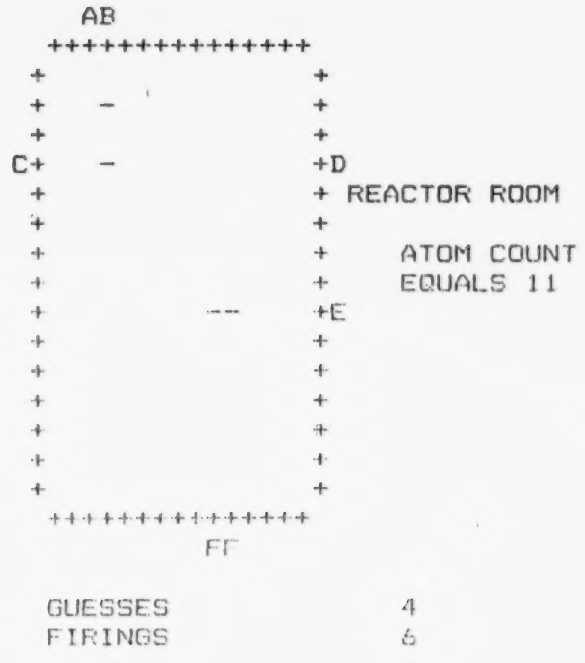


Fig. 14 Reactor game. An excellent PDS program for practicing inferential reasoning. Essentially a black box game.

Almost without a doubt, the most popular of the PDS material used during this project has been two bowling simulation games. The first, obtained on a disk from the Educational Computing Network, is a fairly simple, straightforward simulation. One sets the speed of the ball moving across the baseline, tracks it and releases it.

The second bowling game was one originally developed by Apple Computer as a demonstration and has since found its way into the public domain. It is a rather sophisticated simulation. While the ball still tracks at the baseline, when released it can travel at varying speeds and angles.

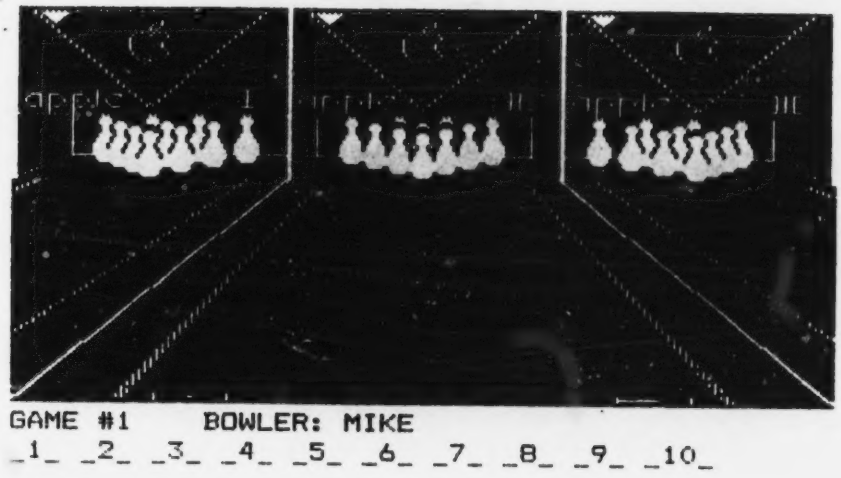


Fig. 15 The Apple-Bowl screen.

Both games are not only engaging, but simply controlled, readily understood by even the most disabled student. They involve competition and a sense of "normal" participation. On a cognitive level, these games can be readily justified as exercises in visual tracking and hand-eye coordination. As a matter of fact, for many weeks the simple bowling game was the only computer activity Paul would participate in. He use it, along with relaxation exercises to control his tremor and hand-eye mediation.

Here was an eighteen year old, physically imposing male interested only in automobiles playing a relatively unchallenging bowling game, over and over, at times to points of extraordinary frustration. Yet he played on and on. To what result? T not only getting consistently higher scores, a sense of accomplishment, but a more controlled state of stress control and a greater ability to discuss and share his feelings.

Another set of programs were originally developed at the University of Washington that utilized scanning as the input and interactive mode. Disks are available in mathematics, language arts, phonics, worksheet preparation and crossword puzzle design. For the motorically involved and/or learning disabled student who must proceed at a more controlled and slower pace, scanning is an excellent exercise. All input decisions are made by pressing either keyboard buttons or joystick buttons at the point where a scanner enters the appropriate command at the base of the screen. The scan speed can be adjusted.

The crossword puzzle maker has been particularly useful not only for the communications arts it requires, but also for those skills fostered in scanning--anticipation, memory and visual perception.

A very nice program called Maze allows the user to construct various mazes of differing sizes, colors, etc.,save them to disk and then have someone follow the mazes created. Following a maze is not nearly so rehabilitative as planning and making one. There are many maze activities available, but few that allow one to actually participate in the construction of them.

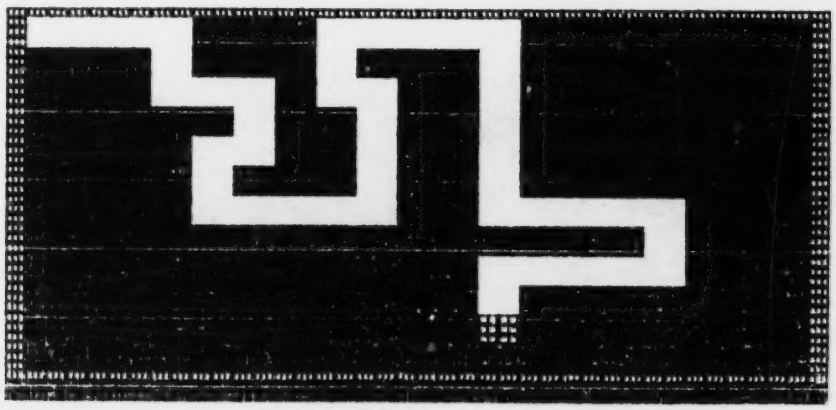


Fig. 16 Example of a maze during construction using Maze Maker.

This maze program was originally developed in Britain, but has come across on disk without any ascription as to original authors and source.

Mix-n-Match is a disk, developed and probably copyrighted in 1981 by CTW, but it seems to have found its way into the unprotected world of PDS. The disk contains four games, one of which is of good cognitive value. The game is called the Layer Cake, but is simply a good graphic representation of the Towers of Hanoi puzzle. The Towers of Hanoi was created in the mid-nineteenth century as a logic and strategy puzzle The puzzle requires that one place a pile of disks, each higher on the pile being smaller than the one below, on a post. Alongside the post are two others. The object of

the puzzle is to move the disks to another post in the same sequence as on the original post and in such a way that one disk at a time is moved and no larger disk ever sits on a smaller one. The Towers of Hanoi (Layer Cake) is a very nice exercise in strategic thinking.

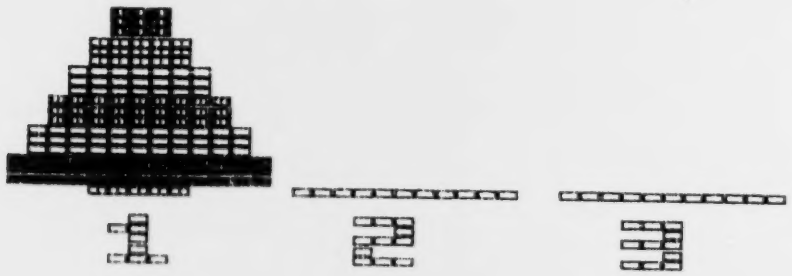


Fig. 17 The Layer Cake--aka the Towers of Hanoi puzzle

New Flight Simulator is an old and fairly simple flight simulator program obtained with no ascription as to author and source, and as with many PDS programs, with no indications of commands and structures leaving one to guess and experiment his way to an operating knowledge of the simulation. It has proved of some value with certain students as an exercise in memory (for the commands), thought integration involved in mediating all the required information, altitude, thrust, elevation, bearing, etc., and the sorts of high level thinking required in simulation.

Beyond the disks already described, a host of others and parts of others within PDS have been used from time to time during the project. Some are worthy of mention. A disk of Early Games and one called Motor Training Games are certainly worth using, particularly with kids in early recovery and more limited cognitive functioning. A version of Mad-Libs is very engaging and instructive. Various older versions of Star-Trek and Apple-Trek are excellent activities involving planning, anticipation and task maintenance.

Even an older, thirteen-sector disk (newer floppy disks are all sixteen-sector types thus being incompatible) was discovered with an excellent little program requiring the flexing of memory and discrimination skills. The activity draws a series of some twenty pictures, one line at a time. The object is to remember the list of picture names shown. The computer randomly selects a picture , reproduces it one line at a time on screen. The player must recognize the illustration and type in the exact name. If incorrect, the computer deducts a point and also deducts points when clues are sought (requesting another line). While it is an excellent activity, it is pesky to run.

Certainly, public domain software is the largest and fastest growing sector of program availability. While its quality may be variable, to say the least, the costs are low, the thrills of exploration and experimentation are present, and the treasures are most certainly out there.

Commercial Software:

As the name indicates, materials in this category are available at the free-market rates and are copyrighted and normally copy-protected. The quality of the programs, their user-friendliness, documentation and support are the selling points of commercial software. These are no mean considerations!

With respect to cognitive therapy, commercial programs can be subdivided into those packages specifically designed for rehabilitation/remediation and those created for primarily recreational use, but which are most suitable for therapeutic service.

A. There is a growing source for specific cognitively-oriented computer packages; only one source used during this project, the least expensive and most reasonably useful was such a source.

The advantages of these packages lie in their very specificity. For there are modules developed just for long and short term memory, for discrimination, for visual perception, for logical reasoning, etc. These modules are normally well-documented, well supported, and they allow for record keeping and progress recording.

Their disadvantages lie in their expense, their cook-book approach to therapy, their lack of adaptability, and their very specificity. For while activities can be targeted, cognition is an integrative facility. Also, most of these packages are directed toward perceptual, not conceptual skills. Perhaps the most damning aspect of, not only these programs, but of most

"problem solving" activities is that once the skill is mastered there appears to be little carry-over to real-life situations or to other cognitive skill areas. This last concern is the primary reason for the emphasis in this project being placed upon open-ended, real-life programs and activities.

The programs that were used during this project were obtained from Cognitive Rehabilitation, located in Indianapolis, Indiana. The software is available in two forms--either as an integrated package of modules, or as a series of single diskettes, each containing several activities.

These single disks, called Soft Tools, are offered for sale annually and represent the disk-formatted version of programs that have appeared in print form within the journal, Cognitive Rehabilitation. The disks cost approximately thirty-five dollars each. An alternative is to subscribe to the journal and enter the listed programs that appear onto disk.

One disk was purchased, SoftTools '83, which contains a number of good and useful programs. Since that time, all subsequent programs have simply been entered from their listings and placed on disks.

The great majority of the SoftTool activities that are directed to perceptual retraining allow for some variations and score keeping. Some require strategic cognition. On the whole these programs are well produced and well targeted and have seen some good and effective use with several Cotting students.

Two examples might well be considered at this point. The first, entitled Trail Trace, asks the player to select the number of steps

comprising the trail and then the size of the grid on which the trail will be placed. The grid is then drawn on screen and the player selects a direction (up, down, L, R). If the selected direction matches the first trail step, it appears. If not, a buzzer sounds and nothing appears. Assuming a match, the player then tries to match the second step and so on until all the steps have appeared. Whenever an incorrect direction is entered, the entire trail to that point disappears, and the player must start entering the directions all over again.

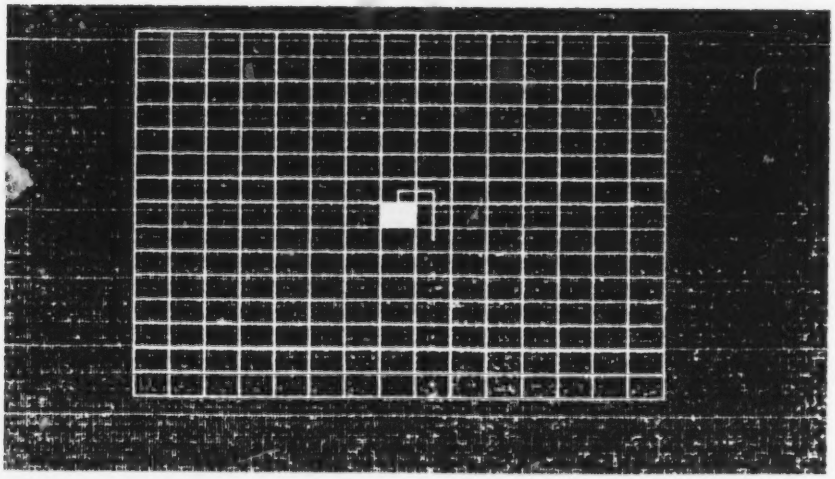

Fig. 18 Trail Trace

This game requires effective planning, visual memory and memory. While seemingly frustrating, like many computer generated activities, the more frustrating it is, the more engaged the player becomes.

A second SoftTool's activity, called Sequential, begins by drawing eight framed rectangles, then filling in each one with a design. The design is, in reality, a series of steps in the creation of the finished design. The task of the player is to highlight, in proper sequence, each step in the design construction.

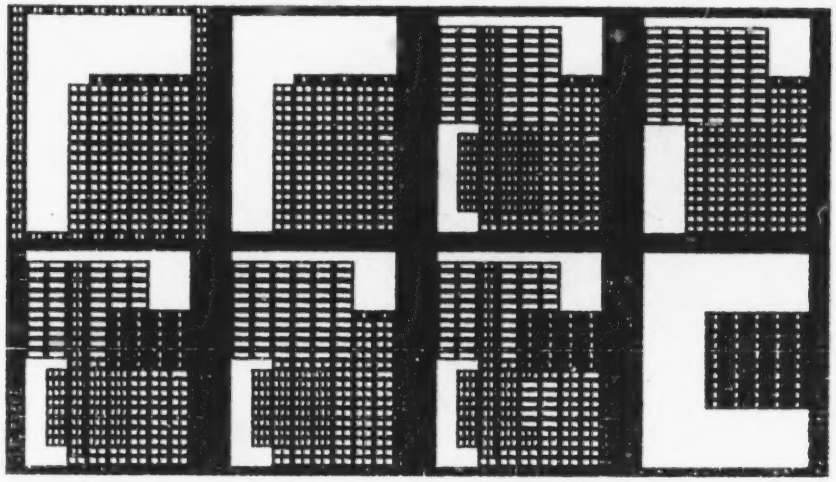

Fig. 19 Sequential. Blocks are in varying colors. The highlight around the upper-left box can be moved to select the desired sequence.

B. Consideration of the commercially available software through the general marketplace will begin with that produced by Sunburst Communications of Pleasantville, New York. The reason for such placement is the programs serve to best illustrate the excellence of educational materials available as well as their over-riding shorcomings.

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The following Sunburst packages have been purchased and used extensively for this project: The Factory, Arrow Dynamics, Discrimination, attributes and rules, Missing Links English editor, and Missing Links classics old and new. Each is extremely well considered, designed and produced. More importantly, each addresses itself to its assigned task with directness, clarity and simplicity. Each is also an enjoyable and highly engaging activity for students.

The true strengths of the Sunburst materials can best by seen by examining the documentation and support for a program like Discrimination, attributes and rules. This package includes some seven disks and an instructional support guide of some two hundred pages of ideas, directions and activities that go beyond just the software use itself.

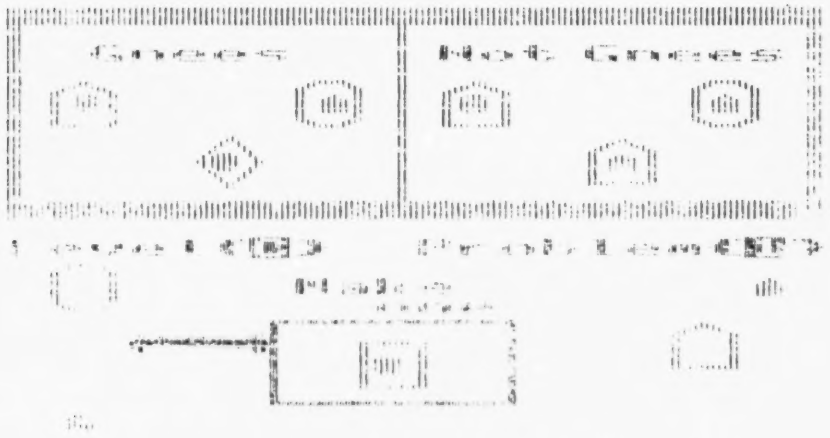

Fig. 20 A screen from Iggy's Gnees (Sunburst), an exercise in the recognition of critical attributes--a fun and profitable activity.

The focus of Discrimination, attributes and rules is on the development of logical skills,from those of discrimination to Boolean logic. While the program description advertises itself as directed to K-6 grades, it has been found very useful for adolescents and adults, including this author.

One of the best of the activities is entitled Ten Clues. In this game the player is presented ten clues, one at a time, and tries to guess the answer as early on as possible. The clues are divided into those attributes of the answer that are critical to its identity and those that are variable. So far, this is a rather simplistic game, but Ten Clues encourages the user to not only play, but to create games. In this mode the player must truly work on conceptual skills. He must select an answer, then characterize it by identifying those attributes that critically define it and those that are non-essential but helpful to identity.

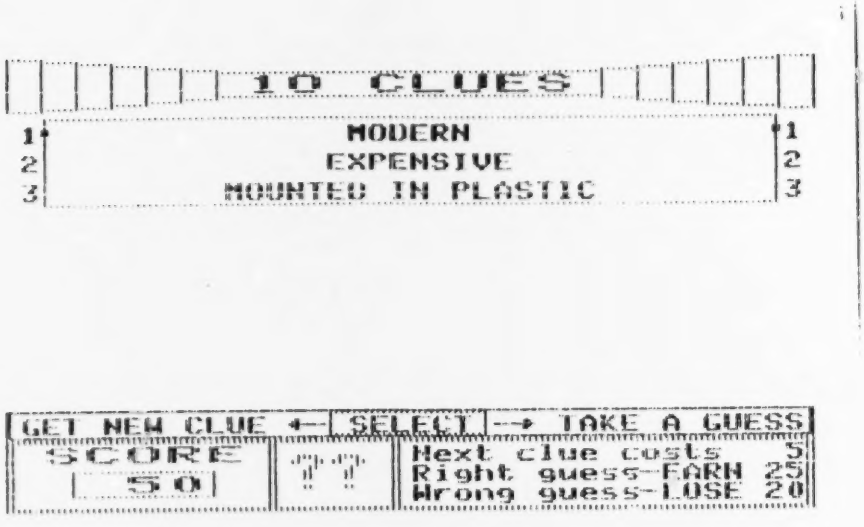


Fig. 21 The game of Ten Clues(Sunburst) in process. The little block by the first number(1)indicates that it is a critical clue/attribute.


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Just as in the mazes activities described previously, the usefulness is not in going through the maze, but in contructing it.

As remarkable as the Sunburst packages are, they do demonstrate their, and others' greatest shortcomings. The advertising and documentation tout that these all are problem-solving activities and tools, and that users will become effective, logical problem solvers! This has simply shown to not be the case and probably never will.

All of the activities help teach and build certain skills of logical thought--skills used in problem solving. But one simply cannot learn to solve a real-life problem by practicing "and-or" logic patterns. The generalization of particular skills developed in isolation, no matter how well and thoroughly, just does not happen. Skills must be flexed in concert, in isolation, in synchrony, and in disharmony, but always in an integrated and patterned way--a way which engages these isolable skills in novel and interdependent ways.

The Bank Street Writer has proved its usefulness as a simple and accessible word processor for students seen in this projects. The word processor has been utilized in two ways. First, each student is required to keep a daily log of what was perceived as happening during each session. No matter how little or much, each had to produce something for saving on disk.

Students had great difficulty with this assignment, writing either nothing or only a tortured sentence. Having a blank screen stare back at a person who has trouble in initiating and maintaining a task is an ominous threat. Nevertheless, it is a very important one to be met and dealt with.

Another assignment with Bank Street Writer involved several simple problems saved on formatted disks and presented to the student. A situation such as, You missed your school bus today. What do you do? What is the problem? Alternative actions? Which would you select? This assignment was particularly useful after other problem-solving strategies had been considered.

The quintessential "find" of the year is a game called Sundog. This role playing science fiction adventure game is produced by FTL of California and costs about forty dollars. It will be described more fully in the pages that follow. Suffice it to say that it is this piece of software that has proved of the greatest value in the practicing of thinking skills during the course of this program.

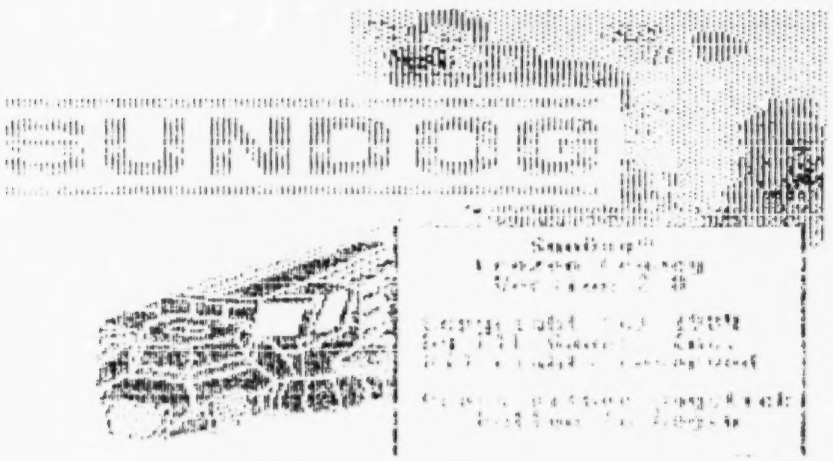

Fig. 22 The opening screen of Sundog

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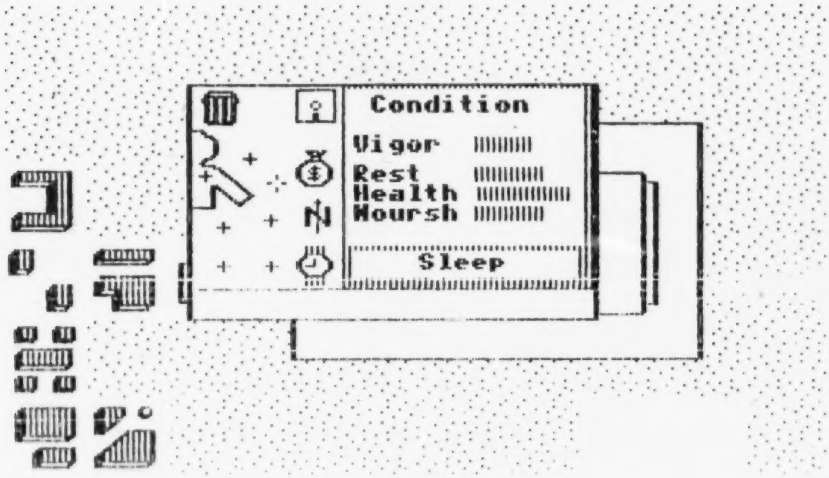


Fig. 23 The character's condition chart that can be called at any time,in this instance overlaying the diagram of the rover pod, which in turn overlays a city section screen.

## SUNDOG AND COGNITIVE THERAPY

Michael Feer

From an Article Submission

Along with many other therapists attempting to remediate cognitive skills in brain damaged individuals, I spend a good deal of time searching through commercial games software for approaches, tools and strategies. So it was that several months ago I found myself perusing a games store of the Dungeons and Dragons type.

During conversation with the salespeople about Apple compatible games, text demands,peripheral needs and the relevant therapeutic concerns, a newly released game was



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handed me for consideration, Sundog. SunDog, created and released by FTL games in 1984, is a science fiction, role playing game featuring Zoomaction screen, window and icon game flow, entirely accessed by joystick and buttons. Written on both sides of a floppy diskette, the game side and the utilities side, it allows the creation, storage and playing of up to eight games.

The game is remarkably rich in character options, encounters, places to go, ways to get about,and windowing capabilities. The central character must make constant decisions--social, travel, as well as monetary. One can play SunDog with or without any regard to the stated game tasks and play it in as simple or as complex a manner as the player wishes and/or needs.

Playing SunDog requires one to monitor regularly the state of one's health, sleep and food consumption. The player must also monitor finances--the amount of money on hand, in various banks, and money owed. Failure to keep track of these very real aspects of life results in very real consequences--loss of money, starvation and death due to fatigue, all of which have happened to my student players.

One particular student has been playing SunDog for about five months as of this writing, not continuously, yet most assiduously. The boy, C.D., described below did not know at age 16 how to read money numbers with any meaning. After five months of going broke and wondering why while playing SunDog, he has justrecently considered the value of

slowing down long enough to read the numbers and has surprised himself in his ability now to read and understand monetary notation.

At the present, I am using SunDog with three brain- damaged adolescents as part of a cognitive rehabilitation program at the Cotting School for Handicapped Children. The rationale for its use differs greatly with each student, but SunDog has amply demonstrated its adaptability to the purposes that I have demanded. The remainder of this article will describe the uses to which I have referred SunDog,with specific regard to the three students playing it.

A.B. (initials fictitious) is a 12 year old male who suffered brain damage in a motor vehicle accident in 1977. The residuals of the accident are right hemiplegia, scoliosis, awkward gait, a reading disability and social disabilities, unpredictable temper and impulsivity consequent to disinhibition. A. Was captivated by SunDog at first encounter. At each session, he sits purposefully and in absolute control of the game and its exigencies. Contrary to demonstrating impulsive behavior, A. maintains a very conservative approach to the range of possible adventures lying at the press of a switch. At times I have deliberately asked A. to try something new and if he wished to attempt some interplanetary trip. At each suggestion and push, A. has responded with very deliberate reserve.

When I first met A. I had him do some drawings on the computer with a Koala Pad. I find such an assignment useful in

observing impulsive and perseverative behaviors, even projective mechanisms. A. did not perseverate, but produced a number of original, yet very tightly controlled geometric designs. In each construction there had to be definite closure. It was my impression from such presentation that A. is a child who often feels out of control and needs protective closure. He has adapted to this sense and need by approaching a novel situation with great reserve and suspicion. A. has approached SunDog in precisely this manner.

SunDog puts a premium on controlled, structured involvement in a multi-layered and often chaotic universe. It is precisely in such a simulation game that A. can learn to deal in an unthreatening way with his fears of lack of control and need for some comforting closure. The game provides a crucial tool for such therapy. A. is learning that he is in control of the game's demands and that he is in control of his own demands. The game offers the therapeutic milieu, a most compelling milieu, one that allows best for play and simulation.

Given its many random encounters with people and aliens and the numbers of choices available, SunDog is also useful for practicing and developing social and decision-making skills. During encounters, the player must read, process and decide rather quickly, for if decisions are not made quickly enough, the computer takes over , leaving the encounter in its control. The game, then might be used to increase reading, language and central processing skills.

Why, when so many other materials and modes are available should I use a game and tout its service for such uses? There are several reasons I can offer, but none with such conviction as the intensity of involvement and the high levels of motivation I see as the game is played. It is obvious that other, consistently applied methods work, but I would argue that they lack the intensity of relation, hence internalization of skills.

As an example I would cite C.D., a 16 year old boy who has the Tetralogy of Fallot as his primary diagnosis. He is highly impulsive and distractable that he finds it nearly impossible to sustain a subject of conversation for more than a minute or two, and shifts back and forth. C. is also terribly anxious when confronted with any novel situation. He loves science fiction and writing stories, but cannot sustain the writing. I have used the Bank Street Writer as a motivating tool to maintain task for his writing and language skills with some success.

When presented with the possiblity of playing SunDog, C. was overjoyed. I assumed that in a short time, given the randomness of occurrences, complexity,and choices contingent on play, he would soon tire and his interest would flag. To the contrary C. has been totally enraptured by SunDog. He still chases madly about from encounter to encounter and from planet to planet, yet he is becoming more cognizant of the need to slow down, to think and plan. He handles the joystick quite impulsively and perseverates on moving it about its four straight edges. Yet even that is changing--slowly, but changing, to a more deliberate set of movements, controlled more by his

finger tips. While he is still anxious about encounters with beggars and robbers (where once he rarely came out of the ship once he discovered encounters), he is now willing to explore more. I cannot but believe that these strategies, given support, will spread to other and more real situations in C's life.

E.F. is a 16 year old male who was struck by a car in 1982. Along with mild encephalopathy, he has difficulty in balance, some facial (7c.n.) palsy and Abducens (6 c.n.) palsy and can be rather immature and inappropriate. E. also was quite private before the accident, and this trait has become exaggerated since then, making it very difficult for him to discuss and share his feelings. E. was also a pre-trauma learning disabled child. There are now visual problems as well.

E's reading, central processing and decision-making skills can be developed with SunDog because of the nature and random frequency of the encounter statements, which require quick mental action. His eye-hand deficits can be ameliorated because of the demands of joystick and screen use. A surprisingly beneficial use of the game lies in the need to continuously move and track the cursor that represents the character's position at all times. E. often loses the cursor on the screen and then begins perseveratively searching for it by exaggerated stick movements. The loss of cursor is due to long-standing perceptual deficits, post trauma neurology and visual field neglect. His enthusiasm for SunDog allows remedial work to proceed in an enjoyable, not overly frustrating and purposeful manner.

Discussion:

SunDog is not the final solution to the problem of cognitive rehabilitation. It is a tool; a tool that must be approached and used with high sensitivity to individual needs and selectivity with respect to clinical presentation. Although A. is left-handed and another child I have with an elbow amputation plays the game successfully, care must be taken to see that the user is physically capable of playing with joystick and buttons. The use of SunDog must be accompanied by sensitivity, structured support and other therapeutic modes appropriate to the unique needs of the user.

The great caution is that the head-injured/learning disabled user may become overwhelmed in the game's colors, screens, choices, travels and encounters. In the limited experiences I have had with SunDog, I have not found this to be the case; on the contrary, rather than being frustrated by the game's demands, each student's strong motivation has overcome the possibility of being swamped. It is just this aspect of arcade and simulation games that allow their use in cognitive therapy. It is for this reason I so strongly recommend SunDog.

Since using SunDog as a therapeutic device, I have seen several reviews of the game in various computer magazines. One consistent criticism noted has been the lack of clear documentation supporting the program. While true, this situation has in no way adversely affected the nature and quality of play by my students. On the contrary, knowing that there were no answers available probably assisted their daring and involvement.

So real has been my students' involvement with SunDog's realities, that in some five months, not one has ever expressed the slightest interest in learning what the built-in objects of the game are. They seem to be more involved in adapting to the real-life demands of the game and in adapting its rules to their own realities.

Project Planner

From a Software Review Submission

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Program: Project Planner

Source: Applitech Software, Inc.
381 Harvard St.
Cambridge, MA 02138

Reviewer: Michael Feer
Cognitive Therapist
Cotting School for
Handicapped Children
241 St. Botolph St.
Boston, MA 02115

Computer: Apple II, IIe, IIc

Requires: 64K or 128K
Two disk drives
Printer--highly recommended

Cost: $190,000

Description:

Project Planner is an application software package designed and marketed essentially for use by the business community. Typically, business projects require rapid decisions based upon a host of complex, lengthy and variable projections of too-often nonexistent data. Such projects must make the most efficient use of time, money, personnel and information in order to foresee,

oversee and realize works ranging from the contruction of a building complex to designing a world traveling tour to designing the scenery of a play.

Early on it was realized that the computer is a natural instrument for the manipulation of such large and complex bases of information for decision making. It only remained for the requisite technology (computer availability, resident memory capacity, and software developers) to move into confluence with the management technique. At the present time, there are a number of such project management packages on the market. Project Planner by Applitech possesses three advantages for educational and clinical use: first, it is simple to learn and use; two, it is a well-documented and supported package, and three, the price is moderate in comparison to related project managers. In addition to the above considerations, Project Planner is designed for the Apple computer, the II series, a fact which makes it more accessible to educational settings. The program can run on 64K memory-40 columns as well as 128K-80 column style.

What does a computerized project manager do? To quote from the Project Planner introduction:

"Project Planner behaves like a smart assistant who can actively help you organize sketchy ideas into complete project plans."

And later in the introduction:

"Project Planner is a visual tool. Even if you can't visualize your project as a whole, Project Planner can. It will take the pieces and automatically draw the project graph."

Based solely upon the above claims, I think one can begin to see why a business-oriented program might well be reviewed in this column. When initially contacted by this reviewer, the people at Applitech, Inc. were astounded to realize that their program might have relevance beyond the business office and that I was considering its use as a cognitive training/retraining tool.

Program Operation:

The package includes two disks: one startup disk and one program disk (the same diskettes are used for 64K and 128K machines-double sided). Along with these disks, a blank data disk is required for storage of the specific project information. Once the program is loaded, one simply names the project and then begins its definition.

The definition of the project requires a listing of activities and their duration (no particular order required). This listing is then followed by a list of the activities that must precede each of the others--a sequence definition. These lists are automatically printed out, so that hard copies remain.

That is all of the required input. The rest is up to the computer and the changing demands of the planner. Once the appropriate information is input, the program is capable of producing a project graph, which is a visual display of how the entire project is organized. The production of such a graph entails a series of mathematical calculations involving the 'critical path' algorithm. The project graph visualizes rather precisely the flow of critical and variable tasks of the work.

In addition to a project graph, the program will generate to screen and printer a complete schedule of the operation and a graphic time chart of the entire project with calendric notations selected by the planner.

The entire project can be updated, various contingencies placed in, durations altered , and 'what-if' considerations are available for manipulation at any time. The entire program is supported by a clear and highly readable User's Manual.

CLINICAL UTILITY:

Among the higher cognitive skills are those of sequencing, organizing, selecting among alternatives, decision making and following through with the processes involved in problem solving.

One of the difficulties in applying these skills to real-life problems and the learning disabled is dealing with the masses of clutter--lists, assigned values to activities and alternatives, revisions and more lists, getting lost in all the arrows, erasures, and sheets of paper.

Project Planner is clean, clean in the sense of forcing a planner to deal with masses of data and the integration of that data. The user is simply required to list all the activities required in the project. There is no need for them to be in order; this encourages brainstorming. And there is no need for the listing to be rigorously complete as the program can be updated.

I currently use Project Planner with a group of four head-injured adolescents. All four are now well past acute recovery, live at home and commute to the Cotting School daily. The students range

in age from 13 to 18 and share one rather significant region of cognitive disability--difficulties in initiating and sustaining the operations of real-life problem solving.

Each of the four is seen individually by me for cognitive therapy, and the group meets once a week to share the common problems of the head-injured. So far, Project Planner has been limited to use in the group in order to establish cooperative problem solving skills.

To this writing, the students have used the program to work on three tasks; planning a raffle, a class trip and a party. While working on the party each person was assigned an activity list to be brought together later and placed in the master listing. One person generated activites for the entertainment, one for food, one for guests, etc.

The computer and program provide not only easier access to the world of complex real problems, but also offer almost instant analysis of the quality of the problem solving effort. For if critical activities are left out of the planning phase, they certainly become obvious in the output.

In the process of using Project Planner, the students are exposed to an alternative method of thinking without being deluged by ancillary and extraneous data. The users are able to focus as best they can on the central task at hand--stating the steps to best solve a problem without the threat of columns, rows, arrows, and figures.

As a computer-based cognitive retraining tool, I should highly recommend the use of such packages as Project Planner.

| Ratings: | |
|---|---|
| Overall Utility: | 7 |
| Technical Quality: | 8 |
| Graphics Quality: | 6 |
| Documentation: | 9 |
| Print Option | 8 |
| Save Data Option: | 8 |
| Modify parameters: | Yes |
| Modify Contents: | Yes |

Table 1 : Reports Print-out of Project Planner
Project Graph not included.

PR#1

| ACTIVITY | DURATION | NAME/DESCRIPTION ... |
|---|---|---|
| 0 | 0.0 | START OF PROJECT |
| 1 | 14.0 | GET MONEY |
| 2 | 7.0 | FIND OUT TRANSPORTATION |
| 3 | 0.2 | GET TO BOSTON |
| 4 | 0.2 | GO TO PARK |
| 5 | 0.5 | AT PARK |
| 6 | 0.5 | GO HOME |
| 7 | 2.0 | PICK A DATE |
| 8 | 0.0 | END OF PROJECT |

| # | ACTIVITY | PRECEDING ACTIVITIES... |
|---|---|---|
| 1 | GET MON | 2 |
| 2 | FIND OU | 0 |
| 3 | GET TO | 1 7 |
| 4 | GO TO P | 3 |
| 5 | AT PARK | 4 |
| 6 | GO HOME | 5 |
| 7 | PICK A | 1 |
| 8 | END | 6 |

ACTIVITY LIST FOR PROJECT CANDLE LAKE

| ACTIVITY | DURATION | NAME/DESCRIPTION ... |
|---|---|---|
| 0 | 0.0 | START OF PROJECT |
| 1 | 14.0 | GET MONEY |
| 2 | 7.0 | FIND OUT TRANSPORTATION |
| 3 | 0.2 | GET TO BOSTON |
| 4 | 0.2 | GO TO PARK |
| 5 | 0.5 | AT PARK |
| 6 | 0.5 | GO HOME |
| 7 | 2.0 | PICK A DATE |
| 8 | 0.0 | END OF PROJECT |



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| # | ACTIVITY | PRECEDING ACTIVITIES... |
|---|---|---|
| 1 | GET MON | 2 |
| 2 | FIND OU | 0 |
| 3 | GET TO | 7 |
| 4 | GO TO F | 3 |
| 5 | AT PARI | 4 |
| 6 | GO HOME | 5 |
| 7 | PICK A | 1 |
| 8 | END | 6 |

SCHEDULE FOR PROJECT CANOBIE LAKE
(DAYS)

| ACTIVITY NBR | ACTIVITY | DURATION | ACTIVITY START EARLY START | ACTIVITY START LATE START | ACTIVITY FINISH EARLY FINISH | ACTIVITY FINISH LATE FINISH | ACTIVITY SLACK TOTAL SLACK | ACTIVITY SLACK FREE SLACK |
|---|---|---|---|---|---|---|---|---|
| 0 | START | 0.0 | JUL-02-85 | JUL-02-85 | JUL-02-85 | JUL-02-85 | 0.0 | 0.0 |
| 1 | GET MON | 14.0 | JUL-11-85 | JUL-11-85 | JUL-31-85 | JUL-31-85 | 0.0 | 0.0 |
| 2 | FIND OU | 7.0 | JUL-02-85 | JUL-02-85 | JUL-11-85 | JUL-11-85 | 0.0 | 0.0 |
| 3 | GET TO | 0.2 | AUG-02-85 | AUG-02-85 | AUG-02-85 | AUG-02-85 | 0.0 | 0.0 |
| 4 | GO TO P | 0.2 | AUG-02-85 | AUG-02-85 | AUG-02-85 | AUG-02-85 | 0.0 | 0.0 |
| 5 | AT PARK | 0.5 | AUG-02-85 | AUG-02-85 | AUG-03-85 | AUG-03-85 | 0.0 | 0.0 |
| 6 | GO HOME | 0.5 | AUG-03-85 | AUG-03-85 | AUG-03-85 | AUG-03-85 | 0.0 | 0.0 |
| 7 | PICK A | 2.0 | JUL-31-85 | JUL-31-85 | AUG-02-85 | AUG-02-85 | 0.0 | 0.0 |
| 8 | END | 0.0 | AUG-03-85 | AUG-03-85 | AUG-03-85 | AUG-03-85 | 0.0 | 0.0 |

E SCHEDULE TAKES INTO ACCOUNT ALL DURATION CHANGES)

TIME CHART FOR PROJECT CANOBIE LAKE

TIME ELAPSED

TIVITY
BER JUL-2-85 JUL-09-85 JUL-16-85 JUL-23-85 JUL-30-85 AUG-06-85

0 START *
1 GET MON ==========
2 FIND OU ==========
3 GET TO =
4 GO TO P =
5 AT PARI =
6 GO HOME =
7 PICK A =====
8 END *

LANATION OF SYMBOLS:

START AND FINISH (DURATION 0)
DURATION OF CRITICAL ACTIVITIES
DURATION OF OTHER ACTIVITIES
SLACK OF ONES ACTIVITIES



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Programs such as Skyfox, Relax and Calm-pute have already been described. They are each well worth the costs involved.

Project Planner produced and distributed by Applitech Software of Cambridge, Mass. is an excellent example of the adaptive use to which a business-targeted product can be put.

Typical of the many computer programs directed to instruction in reasoning and problem solving skills is the Lost R - Reasoning. This program was developed by MCE in 1984. In menu-driven presentation of nine program segments, the user can select between exercises in fact v. opinion, true v. false sets, logical implications and deductive reasoning. The format is interactive and well presented. Some responses allow common usage statements. Much of the deductive reasoning segments are presented as puzzles.

The justification for this program, as with most others, is that it represents a cross-curricular tool to develop logical thinking and problem solving. While this is certainly laudable and the effort is most necessary, the truth is, again, that programs such as this encourage the development of some skills used in reasoning, but definitely do not promote reasoning. The fact that one can solve logical puzzles does in no way indicate an ability to reason creatively or effectively.

While the Lost R - Reasoning is an interesting product, and its presentation of sets is very useful, it suffers from the flaw of inflation. It inflates the puzzle-solving ability to that of problem-solving. That connection is not at all clear and until it is, programs such as this would be best advised to minimize their claims.

Think Fast is a recently released product of Brainpower, Inc. of Calabasas, California. This is a very well thought out, developed and presented product for memory training. The documentation accompanying the disk is of superior quality, and the program itself is well-executed, allowing for either joystick or keyboard input and individual data disk storage for each user. It might be best to understand the Think Fast rationale by quoting from its section on System Overview:
"Think Fast uses a series of timed exercises of increasing complexity and difficulty to test and stretch your memory capacity. The focus of the exercises alternates between the two halves of the brain..."

During its brief entry into the educational software sector, Bell and Howell in cooperation with Instructional/Communications Technology, Inc. introduced a series of modules for reading improvement called Processing Power Program and Word Memory Program. These programs are recommended for their individual adaptability and simplicity of presentation. Since these products have been discontinued and were only discovered by accident on sale, they may be difficult to find but well worth the effort.

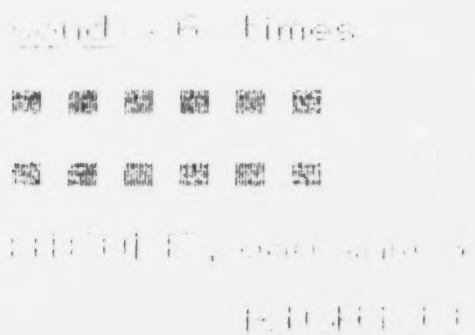

Fig. 24 A screeen from Bell & Howell Word Memory program. This one informs the user that she has successfully identified and pressed for all six random showings of the word "send" as it was flashed.



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Purely recreational arcade games such as Pac-Man, Ms. Pac-Man and Snake Byte are also highly recommended, not only for value as perceptual flexors, but also as stimulation to get the motivational and competitive juices flowing. For children who are depressed, perseverative and have a short attention span,these are powerful reasons to use these game. Many of these allow several players to participate at a time. This is of great value for resocialization and perceived "normalcy."

One company that has consistently produced innovative, high quality and cognitively useful software is Electronic Arts of California. Games such as Skyfox have already been described. Programs like the Music Construction Set, Pinball Construction Set, Adventure Construction Set could be placed in the cognitive gem category, for they require initiation, organization and conceptual strategies. One last Electronic Arts game cannot be ommitted, One-to-One, a basketball simulation match between Larry Bird and Julius Irving. The reality of this game invites truly nerve-racking involvement, Some students,who had to be dragged away from the computer after playing this game, were literally sweating.

The last sample of commercial software to be discussed may well be the most intellectually demanding of all of those noted above. It is called I O Silver. It is produced by Beagle Brothers, a company renown for their host of quality Apple utility programs.

In I O Silver one is required to manipulate a randomly presented set of chips so that sets of identical chips are stacked. When a stack is made, it converts into one chip. If two chips are made and united, they form a calculator. Three united chips will form a computer, and so on,until a main-frame computer is made. Although it can be done, let us say that it is almost impossible to get all identical chips stacked, and then these stacked to produce a winner. With enough foresight, planning, task maintenance and attention to detail, however, the ultimate goal can be met.

In this game,one only plays against oneself. There is though an arcade version of this game, in which little bugs hit the chip mover,resulting in a loss of time for mission accomplishment, but the process remains the same. (This user has not dared yet move to the timed arcade version).

I O Silver is a most difficult challenge for most people, particularly for the head-injured population served at Cotting. These children do not want to play against themselves. Many do not even like themselves and do not want to be reminded of their deficits. It does approach the goal, however, and should not be shyed away from.

It is certain that state-of-the-art commercial software development will improve dramatically, prices will surely fall, and educational adaptability of this software will increase. Perhaps the brightest hope in this

regard is the evolution of artificial intelligence software. Already many business applications using AI have been developed, which involve the very skills being addressed in cognitive therapy. Programs in decision making, conflict resolution, negotiation, which are open-ended and aimed to reality, will be those most useful to the head-injured on his way back to that real world.

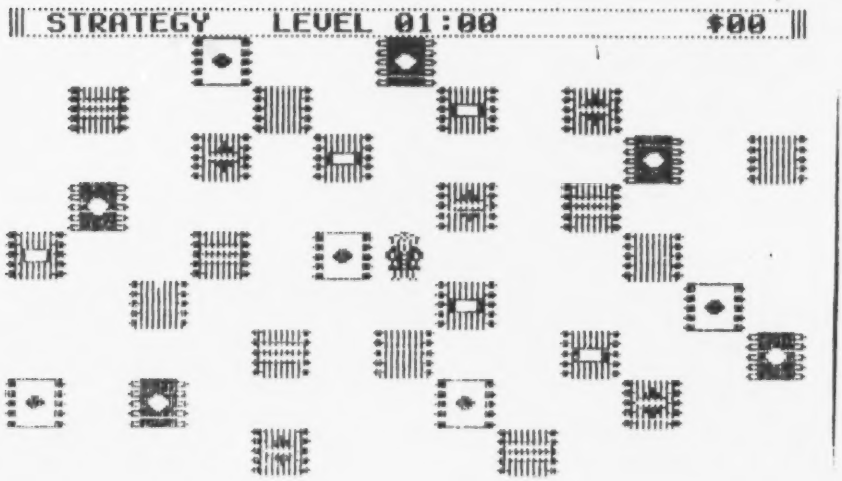


Fig. 25 A screen from I.O. Silver

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## X. Peripheral materials

Supporting the necessary hardware and software configurations of the computer system used, certain other hardware/firmware peripherals make the required adaptations to individual needs more possible.

While not all are essential for remedial work with the computer, some of these peripherals are truly invaluable.

Of prime consideration when working with physically disabled people is the need for alternate forms of input to the computer, or at least assistive devices. Poor hand and arm control or tremors may necessitate the employment of a template to be placed over the keyboard. These templates can be made in-house,or specifically designed ones can be purchased. The value of purchased models is that some come with flip switches, which allow the entry of multiple-key commands (often required).

An alternative key board is quite useful, particularly if it is a touch-sensitive as well as a programmable one. Having such a device obviates the need for purchasing an entire communications package, which is rather expensive and usually centers about a touch pad. The Presfax 100, already described, has served this function admirably. The Presfax is produced by S&S Software of Huddersfield, England. There should be some distribution outlets in this country, but it does seem not to have penetrated

American markets, probably due to some entrepreneurial reasons. It remains, however, an excellent product and worthy of the search for it or a compatible product.

As examples of other membrane keyboards, one may cite the Koala Pad, produced by Koala Technologies Corp. of Santa Clara, California, the Power Pad by Chalk Board, Inc., and a product such as the Sesame St. Muppets alphabet board. These alternative entry devices, while powerful for what they were created for (graphics or alphabet),are programmable for the very experienced user, but more difficult for the casual computer programmer. Rather than encouraging the private development of alternative uses, these manufacturers have followed the line of having other commercial software developers design applications, and then sell them.

The Koala Pad is a very effective graphics tool. With it one can draw and design essentially whatever one wishes with the assist of a number of menu options. One can also save all products to disk. It is in the use of the Koala Pad with head-injured kids that one can clearly see deficits in initiation and perseveration. When presented with the blank screen, as in the case of the word processor, it is very difficult for the child to initiate a task. Play and experimentation are also difficult to obtain.

When the student begins to draw, he/she normally ends quickly or may go on and on producing the same line or color over and over again (example of perseverative behavior).

The student may continue, carefully filling in the entire screen, dot by dot, until the entire field is one color.

As the Koala Pad is useful in observing such behavior, it can also be utilized to change it. By providing small, highly cued assignments,one can break the lack of initiation. By doing this and pointing out the obvious perseverative production, it becomes possible to wean the student from it.

The Koala Pad has also served its part in the Pilot-produced memory program. As noted before, in this program the student sees a series of simple designs for a short time, then writes a description of them. He is asked at a later time to reproduce the drawings on the Koala Pad from the written directions. This is an excellent example of the integration of various thinking, sensor-motor and memory skills and the ability to manipulate several modes of input-output.

The Adaptive Firmware Card, created by Adaptive Peripherals of Seattle, Washington, is truly a remarkably useful product, particularly for the disabled. It is a device that allows for various input devices to be interfaced to the computer. These devices can be touch-sensitive keyboards or hand or foot or head switches. The Firmware card also allows the user to over-ride the keyboard so that all input can be done by a number of scanning modes. All programs running on the computer can be modified while running so that they can be slowed down, accessed

by on-screen scanning, morse code, and/or switches. Messages can also be created and retrieved; this will allow for rapid command of often-used programs.

A provided set-up disk contains the appropriate configurations for a host of games and application programs, such as AppleWorks and the Bank Street Writer. This allows the student to use a word processor with, for instance, a sip-in-puff switch and embedded scanning arrays, which he can select from on screen.

The newer version of the Adaptive Firmware Card is even provided with batteries so that when a customized configuration of program demands is created, it is remembered when the computer is turned off and automatically re-booted when the computer is turned on. In sum, when working with special needs students, the Adaptive Firmware Card is an essential piece of equipment, making its price (some $400.00) well worth the expenditure.

Many of the Apple compatible peripherals are designed to be connected to the game I/O port, which is located within the computer. As this port may well require changing several times a day, or even a session, it is very useful to have an external,easily accessible game port, such as the Scooter II, which enables two devices to be interfaced at the same time; a selector switch decides which one is active.

A good quality and rugged joystick is very important. The joystick allows for so much less frustrating manipulation and control over games and activities than jumping from

key to key. Often times the joystick must be stabilized by the tutor's hand or an attachment to the desk because the student may have only one working hand. Perhaps even better than the spring-centered joystick is the continuous-action track-ball model, which might be more effective for the head-injured user.

A new development called Print-it is most definitely a useful peripheral, though not essential by any means. It is produced by Texprint, Inc. of Needham, Mass. and sells to schools for about $190.00. Print-it allows its user to print in hard copy anything that appears on screen. This is useful not only for report writing, but for preserving a student's on-screen work as it happens. When the button is pressed all programs stop, and the screen can be printed. When printing is completed, the program continues from the point where it was halted. (All illustrations in this report were printed with Print-it.)

New and potentially valuable hardware, software and firmware products are appearing as these pages are being written. Some are designed specifically with the disabled in mind. Mouse-driven capabilities for the newly enhanced Apple IIe and the Gibson light pen and touch-sensitive screens for alternate input are other examples of developing technologies suitable for disabled adaptation.

A product just being released is a touch-sensitive pad (like the Presfax and Koala), which is easily programmable, but also transparent so that it can be mounted right on the screen and used or be held on the lap.

The temptations certainly exist for falling in with the flow of all these developments and breakthroughs. The problems are cost and compatibility. One can easily be sucked into a vacuum cleaner, endlessly picking budgets clean. One must develop enough computer literacy to recognize the compatibility, or lack of,among the welter of products. A printer or a card is nothing without proper cables, dip switch settings, configuration, installation, software and lots of heiroglyphic documentation. This is not to discourage the teacher or therapist, but computers are a new technology with new vocabulary and demands. One should best be prepared for a strong dose of reality. It is very true that a computer will sit forever, patiently waiting for input if the wrong controller card has been installed.

## XI. 'Typical' Session

While the cognitive therapy program at Cotting is, of necessity, a highly individualized one, there are organizational schemes that make a section on 'typical' sessions possible. Typical, however, is placed in single quotes to highlight the fact that 'typical' in these instances is a rather illusory state.

First, there is a consistently applied rationale for all those served by the program. Second, there is the four-sectored organizational approach that all clients encounter. Third, there are specific activities, defined by each sector, which all students participate in.

So, in the exemplary sense, it is possible and useful to discuss what might 'typically' take place during a cognitive therapy session.

Each student is normally seen two to three times a week for fifty minute sessions. An individual record book is maintained for each student and is entered in after each meeting. Notes include mood states, physical states, what was accomplished, and what was not. Along with the written record, wherever practical, permanent records of computer activities are maintained on data disks. Print-outs of activities are also retained, and with Print-it, even more materials will be able to be saved.

The first activity usually involves the Relax software and may occupy approximately fifteen minutes. When all the paraphernalia is set up, a period of baseline readings on the graph are taken,followed by suggestions to lower the stress indicator line. A period of active visualization may follow. During this time, the student might be asked to relax and to visualize his/her kitchen or bedroom--to see it, feel it, smell it and walk around in it. This form of visualization has been immensely successful with several kids. It has been of great value in helping them realize that their mind is capable of impressive feats--it is CAPABLE!

Upon completion of these exercises, the student will usually play the balloon game, again to appreciate the intimate link between mind and body.

In order to effectively solve real life problems, the ability to visualize solutions and alternatives is needed. Play and experimentation are also closely linked to this problem solving capacity; these as well require visualization. The relaxation-visualization tactics go beyond stress control to help enhance problem solving capabilities.

After completing the relax component, one of the SoftTool programs might be used, such as Driver or Anticipation. In Driver, a preselected road width and roadway randomly scrolls by the screen, moving at a preset pace. The student must maintain the cursor within the roadway during the scrolling. At completion, the program informs the player what percentage

of time road maintenance was kept. Anticipation consists of four firing stations at each side of the screen and a rotating target in the center. The target has a wedge-shaped section missing,into which the player must fire, anticipating its position when firing. As the number of hits are recorded, the rotation speed increases, thereby increasing the level of difficulty.

After this, the student might do the memory exercise involving the presentation of the simple figures as developed in Pilot, He might either write the description down or reproduce the images on the Koala Pad. The student might also do a Think Fast round or two.

At this point, about thirty five minutes into the session, the student might do something 'purely' recreational, such as Skyfox or Star Blazer or One-on-one.

Before the session ends, the student must write in their Bank Street Writer log. They are asked to write whatever they did during that session (recall) and their thoughts about what might have been accomplished. As mentioned previously, these notations were usually extremely brief.

So much for a 'typical' meeting. When playing Sundog, the entire period is usually devoted to this game. At times whole periods have centered on relaxation. One student has devoted many complete sessions to writing science fiction stories on the word processor.

At this point it would be valuable to consider in more detail specific case hisotries of kids in relation to software used and progress made.

## XII. Case Histories:

A. A is a seventeen year old boy who was injured two years before the inception of this project. He was riding his bicycle in a Boston suburb while going to the store for his younger brother. On the way he was hit by a car.

As a result of the accident, A sustained a right temporal injury to his skull and brain. He was deeply comatose on hospital admission. After acute management, A was left with moderate right hemiparesis, a right facial paralysis (later corrected partially by surgery) and a right hearing deficit. The nature and extent of the brain injury spared A's verbal abilities, but left him with a number of visual-spatial problems.

Prior to the accident A had been placed under Chapter 766 by virtue of a number of learning disabilities. A was a premature infant with a history of peri-natal seizures. In childhood A presented with hyperactivity and some learning deficits. Before the accident A was also a rather private individual, unwilling to share his internal feelings with even those closest to him.

Several months post-trauma, A's IQ(WISC-R) was 63, and academic levels were quite depressed.

Shortly after admission to the Cotting School, A was referred to this author for supportive conselling. It was decided shortly after that initial contact to concentrate the effort with A on the computer, as his main difficulty lay in his inability to share his sense of loss and grief. A also needed a good deal of perceptual and memory retraining.

In sensitive hands, the computer serves as a very useful projective tool, even cathartic device. For the child like A who will not confide in another person will often project himself on the impersonality of the computer.

From the beginning, A played at bowling on the computer, Before the accident he had earned a bowling trophy and continuously informed the computer of that fact. Little effort was made to confront A with his denials and learning and emotional problems. We simply met and he learned to interact with and to trust the computer. Gradually, a sufficient amount of that trust rubbed off to the therapist--enough to allow A an occasional admission of pain and loneliness.

As the slow psychological unwinding was occurring, more computer demands were placed upon A in terms of memory exercises and visuo-spatial tasks. Always, however, when threatened or insecure, A would return to his bowling--his lifeline to his older self. As the therapeutic relationship grew deeper, A allowed himself to meet with another head-injured student (one who could openly address head injury) while both sat at the computer,at times bowling competitively. A also allowed himself to be confronted by the therapist, but only to the point of near-breakdown, then he would retreat to bowling or some other computer game.

A was making slow, but steady cognitive and emotional progress. He was also very amenable to relaxation, visualization and suggestion. and quite interested in the Relax software when it first arrived at the beginning of this project.

With respect to specific software materials used with A beyond bowling, much use was made of the Cognitive Rehabilitation SoftTools and the Sunburst modules in Discrimination Attributes and Rules. The programs concerning attributes and rules were most effective with A in regard to developing skills in logical reasoning and classificatory attack.

It was during the period of this project that A suffered a significant seizure and required several weeks of hospitilization. Upon return to school, A was very depressed both psychologically and neurologically. These depressions had their root not only in the emotional reaction to traumatic setback, but also to the anti-seizure medication (Dilantin) he was placed on.

At this point all therapeutic concerns shifted to simple maintenance of function and skills. A was also dissociated at this, often interacting with those about him as if he were an uninvolved third party.

It was during this time that the value of the computer for the recovery of this child became most clear. While only tangentially concerned with others, A was engrossed with his interaction with the computer. He might forget many activities, but he was consistently early for his computer sessions. He would involve himself feverishly in activities, particularly bowling. Then Skyfox entered his life, and the two seemed superbly mated. A attacked Skyfox with a vengeance and a single-minded dedication. It was very much as if he realized that in order to maintain his mental abilities at all, he would need Skyfox, no matter how frustrating. And Skyfox, with its emphasis on speedy reflexes and ability to deal with many imputs at once, was most frustrating to A indeed.

No matter how frustrating, A played and played and played Skyfox. Other tasks were tolerated, mainly in consideration of the therapist, but all centered on Skyfox. As his condition stabilized, medications were removed, and his sensorium cleared, he resumed his group participation and began to request bowling again and showed a renewed interest in playing SunDog. Skyfox receded to the background and A has since demonstrated no particular interest in playing it again.

For some two months before his major seizure , A was most consistently playing SunDog. SunDog was a very good match for A for several reasons. First, it required A to read messages clearly, quickly and to respond quickly and appropriately. This exercise was good not only for A's learning deficit but also for his visual tracking problems subsequent to his injury. SunDog also required A to remember a great many things, from money on hand, to his condition, to the planets and cities he had visited, to where he had left his space ship. Once, due to his lack of foresight and memory, A was forced to drive out into a desert somewhere and just die--to end the game. A was just beginning to truly master and enjoy SunDog when the seizure took place. Since that time, he has evinced little interest in returning to play. Hopefully that state of affairs will not last.

A's Bank Street Writer entries were extremely terse, normally less than one sentence summaries of the very last thing he had done during a session. His written instructions for the Pilot-Memory exercises were vague and again terse, affording very little help when he had to reproduce the figures with the Koala Pad. The following are representative samples:

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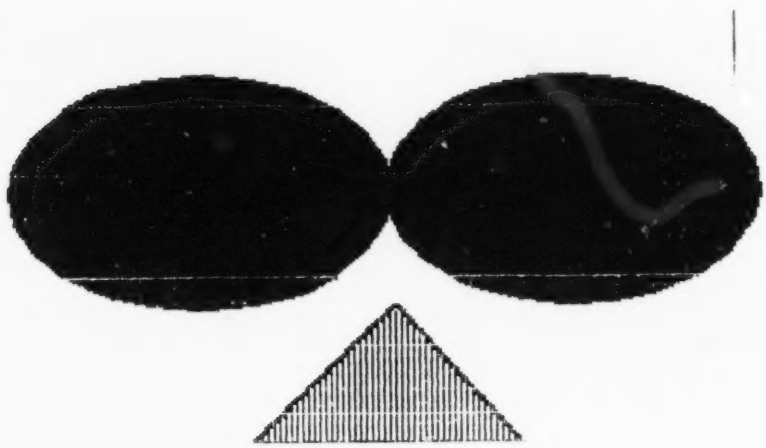
```
CURSOR & RETURN          ESC TO MAIN MENU
RETRIEVE    DELETE       PRINT-DRAFT  QUIT
SAVE  INIT  RENAME       PRINT-FINAL  CLEAR
: 25/85
I like skeyfox  i think it is
a wonderful game.
```

Fig. 26 A typical Bank St. Writer journal entry of A.



Number One

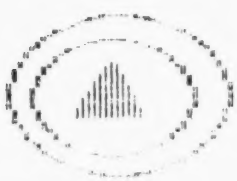


Fig. 27 A Pilot-Memory figure above, with A's reproduction of it, based on his own written description and memory.

Given A's unwillingness and inability to share of himself, these productions should not be surprising.

The Pilot-Memory reproduction illustrated is typical and representative of A's visuo-spatial problem. With more work of this sort, this difficulty (while certainly not eradicated) could be ameliorated with splinter skills, such as writing good directions rather than relying on visual memory.

Fig.28 A Bank St. Writer screen presenting a problem to A. He must answer the questions below the problem.

As A still has two more years at the Cotting School, the computer will remain an integral part of his curriculum and cognitive therapy. It has already demonstrated its applicability, even necessity and adaptability to the needs of a kid such as A. A is typical in his post-traumatic loneliness. The head-injured has lost time, sometimes years while friends have not. They continue



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to grow and leave their mate behind. The head-injured may find it impossible not only to keep up, but even to attempt to.

The computer can serve as a non-judgemental, non-speaking, interactor. It may be confrontive, frustrating, even threatening, but those are all seen as the demands of 'normalcy'--what kids do in arcades everyday! They do not remind the person of his injuries and limitations as a parent, or brother, or therapist does. Herein lies one of the true values of the computer for the disabled and one of the reasons why it works.

A still has a long way to go towards recovery. How far that will proceed is quite impossible to say. But it is very possible to aver that without the intervention of supportive cognitive therapy and the personal computer, A's recovery would not have come as far as it has.

B. B is a sixteen year old girl who was involved in an automobile accident in the summer of 1971 when she was three years old. As a result of the head injury sustained, B was left with left-sided hemiparesis, some difficulty in speech production, poor short term memory, language comprehension deficits and some behavioral control problems.

Most of B's academic life has been spent in public schools. In 1983, B entered the Cotting School. Her experiences at a suburban Boston public school were poor. She had been taunted and isolated for walking and talking funny,and her self-image was suffering badly. Her referral and admission to Cotting seems to have been effected for these reasons.

B is a sociable and cooperative young woman, who has grown up with her head injury and adapted to the best of her ability to it. She is quite open in discussion about the injury and her feelings about its consequences, both personal and social.

Her cognitive deficits lie in two primary areas--short term memory and its effects on knowledge acquisition and comprehension, and second in the area of impulse control.

B becomes frustrated very easily and tends to react very expressively, even explosively. At times she will simply walk out of a class. At other times she will yell, or on rare occasions strike out physically. Walking out is actually a good technique for the impusive head-injured. For when tensions run so high, time and space outside is an effective remedy. One of the positive signs of increasing

impulse control is that the person recognize that rise in tension and withdraw .

Therpeutic effort has been directed not only along the path of talk-counselling, but also towards the use of the Relax software and other modes of stress control. B has been an active and interested participant in work with Relax and is very effective at the balloon game. The difficulty lies in applying these strategies beyond the computer sessions. With continued practice, however, it is hoped that this transfer will indeed take place.

With respect to B's memory deficits, the perceptually-oriented computer programs have been most useful. When tasks, which are multi-levelled and/or multi-stepped are presented to B, she loses her way and becomes very frustrated. This feeds into her poor impulse control. Again, the integral nature of cognitive realms illustrates the futility of isolating remedial tactics.

Of the SoftTools most appropriate for her, those considered best were activities such as Symdig and Visual Search. In Symdig, a group of arbitrary symbols are presented in a row at the top of the screen; beneath them are a series of numbers in a one-to-one correspondence to the symbols. Below these rows is a series of rows containing the symbols but missing their corresponding numbers. The player must enter the correct number for each symbol as quickly as possible.

Simultaneous Multiple Attention presents a randomly generated string of letters that march continuously across the screen. In the screen center, a letter appears in brackets. The object for

the player is to press the space bar as soon as the matching letter steps into brackets just above the bracketed letter. As one becomes better, two marching lines appear and one must watch both for the matching letters.

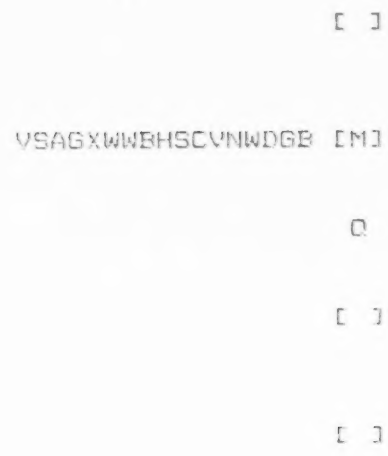


Fig. 29 The SoftTools screen for Simultaneous Multiple Attention. On screen, the marching rows are bordered in black.

To work on B's memory as well as to direct the link to comprehension, the Bell & Howell programs have been of great service. The Word Memory program is in many respects similar to Visual Search noted above. Strings of words randomly flash along the screen moving from left to right. One must quickly press the space bar as one sees the target word (which the user has just read in sentences). At the end of the round the computer counts the number of times the bar was properly pressed. If incorrect, the program will remember and make the user do that word again. There are other activities on these disks just as

appropriate for a student like B. The other Bell & Howell program is directed to story reading, but lines can be presented in as short a span as three words. The exercise of tracking the line flow from left to right is again an excellent one for B. These activities are much like those of the Controlled Reader series, which are also very good.

The Pilot-Memory exercises are also good for developing short-term memory skills, but just a bit more complex in its demands than the others because of the multi-tasks involved in its completion. It is precisely this practice in sequenced demands, from simple to complex, to more integrated challenges that are the most suitable cognitive skill builders.

Other very useful programs addressing more conceptual functions with B have been the Decision exercise and the Project Planner. These two allow single-step, open-ended entry in a clear and heavily cued form. These are essential traits for B's comprehension.

Fig. 30 B's response to missing the school bus problem,on the Bank St. Writer.



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As B learns to deal better with stress, her ability to concentrate for longer periods on cues will aid her comprehension, and as she develops more consistent comprehension skills, her impulsivity will come under greater control. Both must be addressed in an organized, calm and supportive environment.

C. C is a twenty year old young man who was head injured at the age of nine. He received a basal skull fracture from a door that fell on him. The injury left C with diffuse brain damage, damage to the right cerebral cortex, and pathology in the circulation to his brain. He also had to have a plate installed at the frontal portion of his skull.

The accident left C with a moderated hearing loss, which now requires a hearing aid, a left hemiplegia, a host of behavioral problems and some moderate cognitive difficulties. His brain is in a state of almost continuous inter-hemispheric seizure, and circulation to the brain has been greatly compromised by the accident and subsequent surgical interventions.

C's cognitive problems arise from the more severe damage done to his right brain. While sparing his verbal language skills, his nonverbal, spatial, synthetic skills have suffered. We are presented with a student who can rather easily do high school algebra, but who cannot apply the lessons of one problem to another.

C is capable of doing very well at almost any task requiring good reasoning skills. All of the Sunburst software was used with C, and he is well able to deal with the logical demands of any of it. Arrow Dynamics, the computer programming Sunburst package was handled very well by C. He could deal effectively with attributes and rules with the Sunburst materials as well as the activities in the Presfax disks. C enjoyed creating games, such as word-search puzzles, crosswords and the Ten Clues game.

C also did very well in exercises like Think Fast and the Lost R - Reasoning. So, where is the difficulty? The problem

lies in two areas. first, C is almost incapable of transferring his logical skills to true problem solving, and second, because of the damage done to his right brain, he has great difficulty with visuo-spatial tasks.

C demonstrates all-too-clearly the wide distinction between logical thinking skills and conceptual skills--of 'real' problem solving. Mastery of logical reasoning is not mastery of applied thinking, generalisable thought, creative thinking or lateral (a la DeBono) thinking. While C easily solved the Towers of Hanoi puzzle, he solved the problem of what to do when locked out of his house by knocking down the door.

Any spatial activities, such as the Pilot-Memory program, gave C trouble. Although his written description may have been adequate (?), the resulting reproduction bears little resemblance to the original.

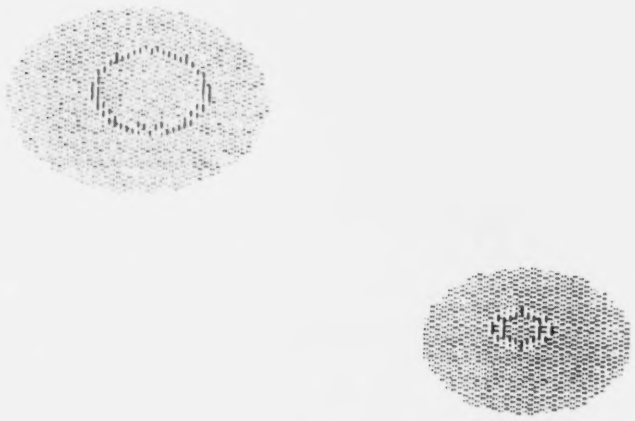

Fig. 31 C's Pilot-Memory reproduction of the same figure shown in Fig. 27. His description reads: Two large circles (white) and a triangle exactly in the center (red).

When asked to create a maze with the Maze Maker disk, he completely lost himself just in the process of laying out a very simple one. Sunburst activities involving spatial skills, such as the Factory and Discrimination were quite frustrating to C.

C presents behavioral disorders, which contribute to the above problems. C has demonstrated forms of emotional disorganization since his accident, often in the form of delusions and hallucinations, and at other times, as threatening and aggressive behaviors. Even now, although the aggressive behaviors have largely abated, C's thought disorganization persists. He constantly creates untrue stories about his home, social and work life, yet he believes them most of the time. "Most of the time" must be emphasized because there are times when he realizes what he is saying and doing. It is at these times that C is most depressed, even suicidal.

Eleven years after the accident, C remains a fairly isolated and very lonely individual with no coherent career plans, and a poor ability to make such plans. He still cannot talk about the injury or about himself as a head-injured person. He retains a very poor self-image. And probably, were it not for his delusions, he might well have committed suicide by now.

So, what to do in cognitive therapy with C? His major deficit lies in the inability to transfer and translate his more than adequate skills to the integral demands of real life. Most effort, then, has been directed to supporting and enhancing those needs. With respect to software, the most useful has been Decision and Project Planner. All the other disks used and mentioned above

**Table 2 : Typical Project Planner print-out og C.**

TIME CHART FOR PROJECT SURPRISE

```
                    TIME ELAPSED
ACTIVITY
NUMBER  JUL-1-85     JUL-09-85     JUL-17-85     JUL-25-85     AUG-02-85  AUG-1
---------+-------------+-------------+-------------+-------------+-------------
  0 START   *
  1 INVITE  ==========
  2 BUY FOO           ==============================
  3 GET PLA                                        =======
  4 THINK O                                              ==
  5 HIRE D.                                                ==========
  6 SELECT                                               ----.........
  7 HIRE OP                                                    ----.....
  8 BUY LIQ                                              -------.......
  9 GET DAN                                                        .....
 10 END
---------+-------------+-------------+-------------+-------------+-------------
```

EXPLANATION OF SYMBOLS:

```
*     START AND FINISH (DURATION 0)
===   DURATION OF CRITICAL ACTIVITIES
---   DURATION OF OTHER ACTIVITIES
...   SLACK OF OTHER ACTIVITIES
```

ACTIVITY LIST FOR PROJECT SURPRISE

| ACTIVITY | DURATION | NAME/DESCRIPTION ... |
|---|---|---|
| 0 | 0.0 | START OF PROJECT |
| 1 | 5.0 | INVITE PEOPLE |
| 2 | 14.0 | BUY FOOD |
| 3 | 3.0 | GET PLACE |
| 4 | 1.0 | THINK OF GAMES TO PLAY |
| 5 | 5.0 | HIRE D.J. |
| 6 | 2.0 | SELECT MUSIC |
| 7 | 2.0 | HIRE OPEN BAR |
| 8 | 5.0 | BUY LIQUOR |
| 9 | 2.0 | GET DANCING GIRLS |
| 10 | 0.0 | END OF PROJECT |

PREDECESSOR LIST FOR PROJECT SURPRISE

| # | ACTIVITY | PRECEDING ACTIVITIES... |
|---|---|---|
| 1 | INVITE | 0 |
| 2 | BUY FOO | 1 |

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| | | | |
|---|---|---|---|
| 3 | GET PLA | 2 | |
| 4 | THINK D | 3 | |
| 5 | HIRE D. | 4 | |
| 6 | SELECT | 3 | |
| 7 | HIRE OP | 8 | |
| 8 | BUY LIO | 3 | |
| 9 | GET DAN | 5 | 6 |
| 10 | END | 9 | 7 |

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have served the purpose of maintaining and sharpening his present skills and of trying to convince him of his own, very real,capacities. The work has centered on the relevance of one skill area to others, and on making their relevancy and connections crystal clear. Practice, a lot of boring practice,on the Project Planner and great gobs of support were also needed.

C is certainly not a success story. He has just graduated and has no real plans. He has to return to the hospital for further surgery this summer and is significantly depressed about that. His life hangs literally on the thread of his seizure activity and his poor cerebral circulation. He has had a number of recent fall-down seizures, and his behavioral problems are still very manifest.

In spite of such a reality, C's work with the computer does serve to illustrate a proper fit between a user and the programs. C's ability to transfer cognitive skills might get better with more time and effort, or it might not. In C's case, the brain insult is so broad and deep and of such long-standing duration that prognosis is guarded at best. But it is certain that the match between C and the computer was highly appropriate.

## XIII. Additional remarks on software:

As of this writing, there is a veritable deluge of educational software products being marketed as problem-solving-reasoning skills devlopers and enhancers. Two of these products, though not used during this project to date, should receive some consideration. The first is Robot Odyssey by the Learning Company of California, and the second is Chipwits, produced by Brainpower, Inc. also of California.

First, it must be noted that both of these programs are excellent creations for both educational and recreational use. Their rationale, creativity, presentation and support are very nicely thought out and realized.

Both products are widely advertised and praised as mechanisms for teaching, learning, problem solving and reasoning skills. Admittedly, when well used, these programs will achieve the stated aims, that is, in terms of the activities presented.

In Robot Odyssey I, the player finds himself fallen into an underground city, Robotropolis. His goal is to return to the surface world. In order to achieve this, the player must be able to program a number of robots to move through the various levels of Robotropolis. He must not only play the game of escape and maneuver with all the skills required, but must also learn computer programming and all the logical skills necessary for this task.

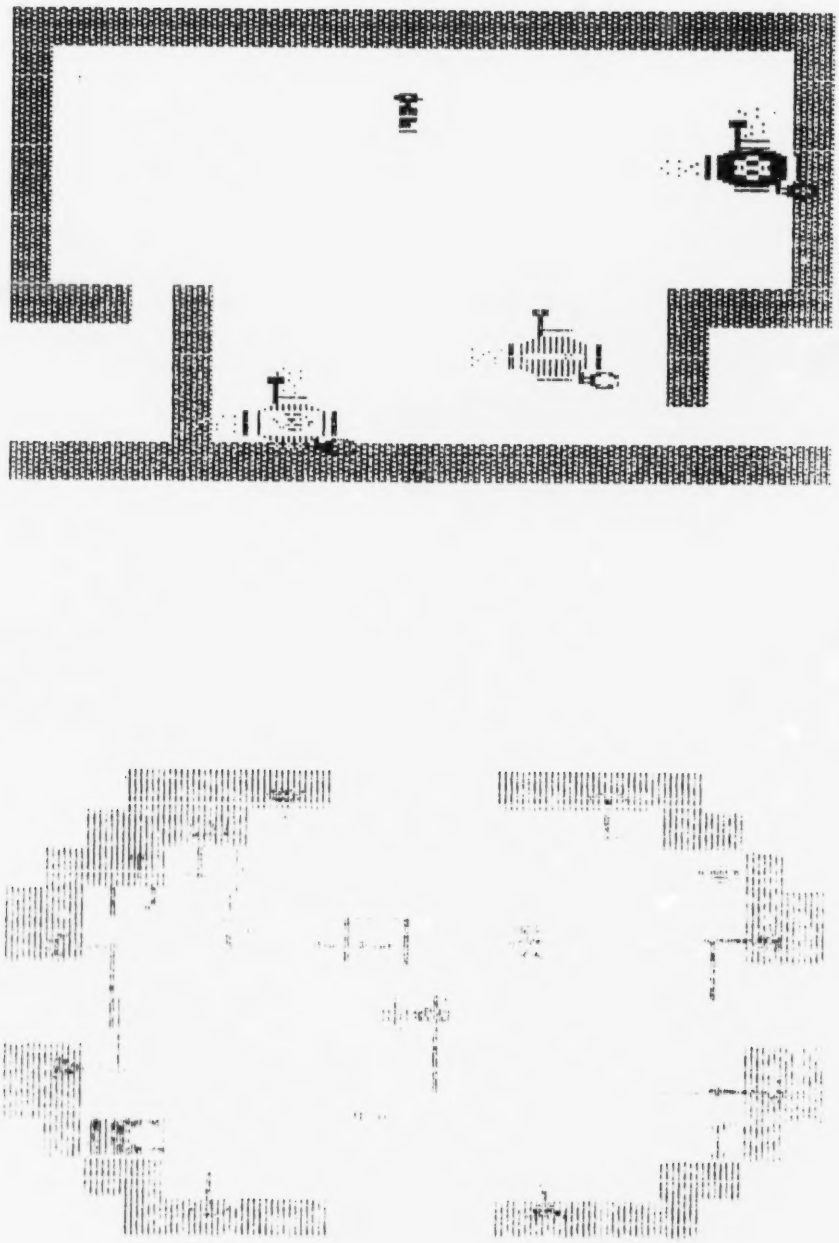

Fig. 32 Screens from Robot Odyssey.c The Learning Company.

The game is truly ingenious and very well executed. One can enter various tutorials to learn about robot anatomy and manipulation, before actually playing the game. Robot Odyssey I is an incredibly rich world where one can test and develop a number of cognitive skills.

With Chipwits, the player is again presented with the challenge of robot programming. In this game, controlled by pull-down menus, the robots find themselves in various assigned environments, each composed of a number of rooms. The robot in a room will do whatever its program allows it. There are a number of objects, including the floor and walls, in each room to be picked up, eaten or avoided. The goal is to maximize the points the robot earns by programming it in such a way as to allow it to move and select from all the encountered objects in the various rooms.

As in Robot Odyssey, Chipwits offers a workroom where robots can be programmed and tested. Chipwits can also be accessed via the Koala Pad. This is an important consideration when adapting for the motorically impaired.

Again it must be emphasized that both of these programs are very well done and almost certainly represent the wave of coming educational software for computer literacy, programming skills, problem solving and reasoning skills.

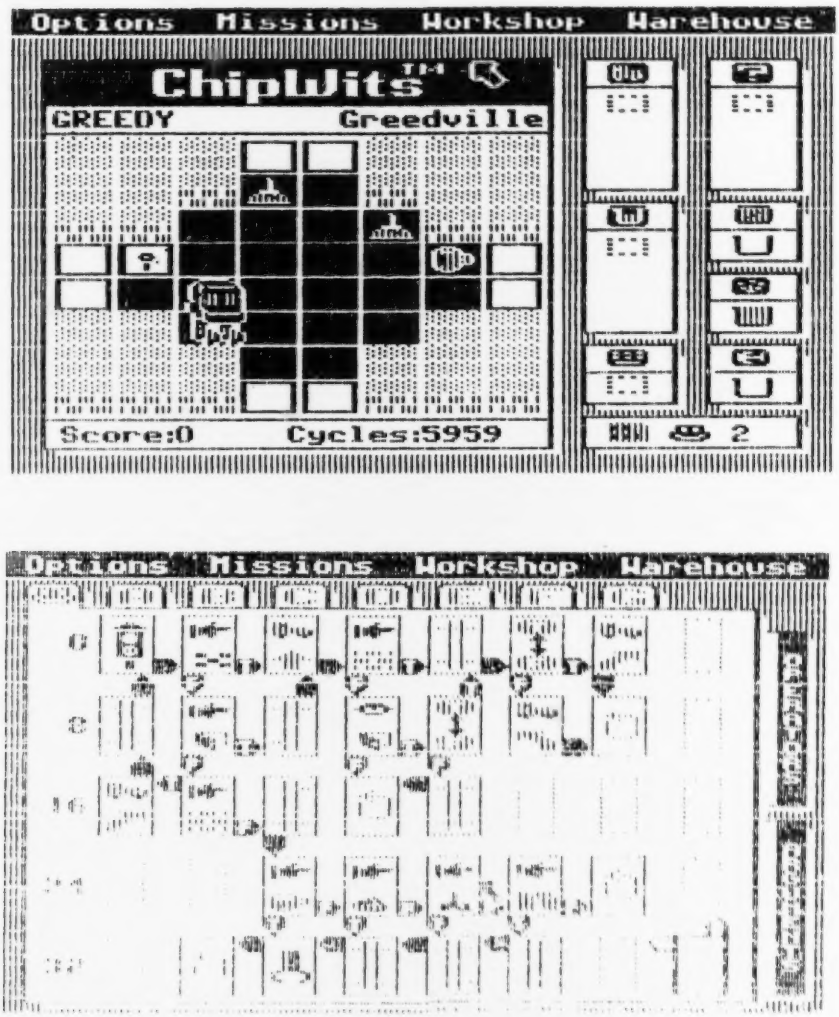


Fig. 33 Screens from Chipwits.c Brainpower, Inc.

In spite of their excellence, these programs have not been used in this project because the students seen do not have the attention span, memory or frustration controls to allow entry into these two worlds. A goal for some of the students might well be to play games such as Chipwits and Robot Odyssey. But this is far off. This is in no way an aspersion of these fine games, but simply an admission of reality.



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Another and central consideration of these products lies in their claims to develop problem solving and reasoning skills. Again, this cannot be stressed enough--to be able to reason logically and sequentially does not indicate the ability to think well, practically and creatively. Because one can program robots in the game, it seems that in reality, one can program robots as well. But playing the games do not necessarily mean that one can better define a problem, select from alternatives, pursue a course of action and justify and feel satisfaction in that course of action.

Desirable as many of these creations are because they do foster development of sets of discrete skills, they really do not develop problem solving skills, and we must not ask of them more than they can be expected to offer.

## XIV. Implementation in the public schools:

It might be best to begin this section by considering the last paragraphs of the last section. A strong view to reality must be firmly held, for not too much must be asked of the school and expectations of the student must not be inflated.

The head-injured child should be placed in his/her home school because that is where recovery will take place most easily and naturally-- within an environment of family and peer support, and amid familiar and comfortable surroundings. Such a move, however, is asking a lot of all parties and is not likely to be accomplished without a good deal of struggle. The reader need only to refer again to the case of Paul who was never seriously allowed back in his home school.

The school may well be limited in its capacity to provide the assumed levels of individual attention needed, and the student may well be limited in his/her ability to adapt and respond to the social/academic time and physical constraints demanded by the school.

The implementation of cognitive retraining facilities for the head-injured student in a school is very much a matter of perceptions (sometimes realistic) on both sides-- fear of differences, safety, liability, stretched resources on the school's part, and fear of rejection, isolation and failure on the student's part. This is not an optimistic portrayal, but if the school is to serve its population and grow as a community of citizens, and the student is to recover as best he can his place in his home community, then

the difficult must be made not only possible but real and comfortable.

As a second carry-over from the last section, one must also firmly bear in mind exactly what the goals of cognitive rehabilitation are and what can be achieved in a school. These are perceptual enhancement through practice, conceptual enhancement through practice, constant reinforcement of the relationship of the two directed towards real-life problem solving. The ultimate goal is for the head-injured child to be able to define a problem, generate alternative paths to its solution, select an alternative, pursue the solution via an alternative, justify the solution and finally feel a sense of accomplishment and satisfation in doing it. It is in the actual practice of doing this that recovery retraining takes place.

Physical requirements:

- A computer system with adaptive capacity.
- Software of enough form and variety to allow individualization of approach.
- A fairly quiet and private space so that a highly distractible person may work in relaxation and with minimum disturbance. It must be private enough to allow him/her displays of frustration and deep emotion.

Also, a time-out space should be provided. Head-injured students with difficulty in impulse and frustration control, who may be subject to bouts of agitation,require a place to go when things crowd in too deeply. It should be a quiet, safe and controllable place--controllable by school personnel and controllable (in the sense of non-demanding) by the student. It is important in the recovery from head injury that the person be able to self-monitor

mood states and be able to initiate the move to the time-out space himself. As important as this self-monitoring is, so is the provision of the safe space.

Personnel --

It is extremely important that the entire school staff be sensitized to the presence of the head-injured (and other disabled) population. Too often, only the immediate teacher, counsellor and some administrators are aware--sensitively aware--of such a presence.

This sensitization should be accomplished by workshops for staff and groups of staff in disabilities, sensitization, stress control and relevant neurological-behavioral concerns specific to the head injured.

The prime tutor for the student(s) must be well-trained not only with computer use, but also in work with the head injured The tutor must be very sensitive to the needs of both.

Time --

The student should be receiving supportive counselling, probably as needed as well as scheduled, perhaps twice a week.

Cognitive therapy sessions should probably occur daily, first to work on skill enhancement and second to support work going on elsewhere.

As many classes as possible should be mainstreamed; this is typically very possible. Allowances should be made for late entry to classes because of mobility impairments as well as for certain

The following pages illustrate two useful tools in modelling the implementation of a program - Think Tank @Living Videotext and the Project Planner @Applitech Software. The materials represent approximations of an implementation process.

These two programs are also useful in the re-training process with head-injured students.

THIS 'THINK-TANK' PRINT-OUT WILL SERVE TO ACT AS NOT ONLY A MODEL FOR CONSIDERING THE NECESSARY STEPS IN IMPLEMENTATION, BUT ALSO AS AN ILLUSTRATIKON OF A USEFUL COGNITIVE TOOL FOR STUDENTS.

1: A. IDENTIFY NEED
1.1: ARE THERE APPROPRIATE STUDENTS NEEDING THIS SERVICE?
1.2: OBTAIN ALL RELEVANT RECORDS INDICATING COGNITIVE STYLES, DEFICITS A
2: B. SURVEY FACILITIES
2.1: 1. PHYSICAL
2.1.1: COMPUTERS, SOFTWARE, SPACE AND TIME
2.1.2: 2. STAFF
2.1.2.1: AVAILABILITY, SENSITIVITY, TRAINING
2.2: 3. IS THERE A FIT OF FACILITIES TO NEED?
2.2.1: IF YES - PROCEED
2.2.2: IF NO - OBTAIN NECESSARY STAFF AND PHYSICAL MATERIEL
3: C. TRAINING
3.1: 1. STAFF PERSON
3.1.1: TRAINED TO THE COMPUTER SYSTEM - SENSITIVE TO REQUISITE ADAPTAT
3.1.2: TRAINED TO NEEDS AND STYLES OF THE HEAD INJURED
3.1.3: TRAINING IN COGNITION, NEUROPSYCHOLOGY
3.1.3.1: HOOK-UP WITH A PRACTISING THERAPIST TO ACT AS CONSULTANT
3.1.4: THIS PERSON MUST BE SEEN AS A RESOURCE BACK-UP AND SUPPORT FOR
3.1.5: STUDENT AS WELL AS THE OTHER FACULTY AND STAFF.
3.2: 2. FACULTY AND STAFF
3.2.1: INITIAL PRE-SCHOOL WORKSHOP ON SENSITISATION TO DEVIATION
3.2.2: EDUCATION AS REGARDS THE HEAD-INJURED
3.2.3: ONE OR TWO [illegible] WORKSHOPS DURING THE YEAR
3.2.4: [illegible] TRAINER BROUGHT IN AS NEEDED
3.3: 3. COMMUNICATION
3.3.1: NECESSARY BUDGETING FOR HARDWARE AND SOFTWARE
[illegible]
[illegible]
[illegible]
4: [illegible]
4.1: [illegible]
4.1.1: [illegible]
4.1.2: [illegible] MEETING(S)
4.2: [illegible]
4.2.1: [illegible] PRIVATE PLACE FOR SESSIONS
4.2.2: [illegible] FOR GROUP MEETINGS
4.2.3: 'TIME-OUT' SAFE PLACE FOR THE KID TO GO WHEN AGITATED
5: D. THE SCHOOL'S COMMITTMENT
5.1: SENSITIVTY
5.2: CONSISTENCY
5.3: TIME, SPACE AND STAFF MUST BE CALM, AND PREDICTABLE
5.4: PREDICTABILITY IS MOST IMPORTANT - THINGS SIMPLY CANNOT
5.5: BE ALTERED QICKLY AND WITHOUT PREPARATION OF THE STUDENT.



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27-JUL-85 COGNITVE THERAPY IMPLEMENTATION MODEL- PAGE i

PAGE

A. IDENTIFY NEED . . . . . 1
ARE THERE APPROPRIATE STUDENTS NEEDING THIS SERVICE?. . . . . 1
OBTAIN ALL RELEVANT RECORDS INDICATING COGNITIVE STYLES, DEFICITS AND 1
B. SURVEY FACILITIES . . . . . 1
1. PHYSICAL . . . . . 1
COMPUTERS, SOFTWARE, SPACE AND TIME. . . . . 1
2. STAFF . . . . . 1
AVAILABILITY, SENSITIVITY, TRAINING . . . . . 1
3. IS THERE A FIT OF FACILITIES TO NEED?. . . . . 1
IF YES - PROCEED . . . . . 1
IF NO - OBTAIN NECESSARY STAFF AND PHYSICAL MATERIEL . . . . . 1
C. TRAINING. . . . . 1
1. STAFF PERSON . . . . . 1
TRAINED TO THE COMPUTER SYSTEM - SENSITIVE TO REQUISITE ADAPTATION 1
TRAINED TO NEEDS AND STYLES OF THE HEAD INJURED. . . . . 1
TRAINING IN COGNITION, NEUROPSYCHOLOGY. . . . . 1
HOOK-UP WITH A PRACTISING THERAPIST TO ACT AS CONSULTANT. . . . 1
THIS PERSON MUST BE SEEN AS A RESOURCE BACK-UP AND SUPPORT FOR THE 1
STUDENT AS WELL AS THE OTHER FACULTY AND STAFF.. . . . . 1
2. FACULTY AND STAFF. . . . . 1
INITIAL PRE-SCHOOL WORKSHOP ON SENSITISATION TO DEVIATION. . . . . 1
EDUCATION AS REGARDS THE HEAD-INJURED. . . . . 1
ONE OR TWO FURTHER WORKSHOPS DURING THE YEAR . . . . . 1
CONSULTANT-TRAINER BROUGHT IN AS NEEDED. . . . . 1
3. ADMINISTRATION . . . . . 1
NECESSARY BUDGETING FOR HARDWARE AND SOFTWARE. . . . . 1
SENSITIVITY TO ISSUES OF LIABILITY, SAFETY. . . . . 1
WILLINGNESS TO TAKE RISKS WITH AN AT-RISK STUDENT. . . . . 1
SENSITIVITY TO RESPONSES OF FACULTY AND STUDENTS TO DEVIANCY . . . 1
D. DAY-TO-DAY OPERATION. . . . . 1
TIME ALLOCATION . . . . . 1
HOW MANY SESSIONS. . . . . 1
HOW MUCH TIME IN MAINSTREAM. . . . . 1
ALLOTMENT FOR SUPPORT GROUP MEETING(S) . . . . . 1
SPACE ALLOCATION. . . . . 1
QUIET, FAIRLY PRIVATE PLACE FOR SESSIONS. . . . . 1
PLACE FOR GROUP MEETINGS . . . . . 1
A 'TIME-OUT' SAFE PLACE FOR THE KID TO GO WHEN AGITATED. . . . . 1
E. THE SCHOOL'S COMMITTMENT. . . . . 1
SENSITIVTY. . . . . 1
CONSISTENCY . . . . . 1
TIME, SPACE AND STAFF MUST BE CALM, AND PREDICTABLE . . . . . 1
PREDICTABILITY IS MOST IMPORTANT - THINGS SIMPLY CANNOT. . . . . 1
BE ALTERED QICKLY AND WITHOUT PREPARATION OF THE STUDENT. . . . . 1



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28-JUL-85 ESTIMATED COMPUTER-RELATED BUDGET PAGE 1

1: 1. APPLE IIE COMPUTER, TWO DISK DRIVES, MONITOR(COLOUR)
1.1: WITH EDUCATIONAL DISCOUNT....$1,000
2: 2. DOT MATRIX PRINTER, GRAPHICS CAPABLE
2.1: ABOUT $400
3: 3. PRINT-IT INTERFACE
3.1: ABOUT $180
4: 4. EXPANDED 80-COLUMN CARD - ADDS 64K MEMORY
4.1: ABOUT $150
5: 5. ADAPTIVE FIRMWARE CARD
5.1: ABOUT $400
6: 6. KOALA PAD AND ACCESSORIES
6.1: ABOUT $150
7: 7. JOYSTICK
7.1: ABOUT $50
8: 8. BLANK DISKS
8.1: ABOUT $150
9: 9. ASSORTED COMMERCIAL SOFTWARE
9.1: ABOUT $1500
10: 10. PROGRAMMABLE TOUCH-SENSITIVE PAD
10.1: ABOUT $200
11: TOTAL.....ABOUT $4100.00
12: ESSENTIALLY A ONE TIME INVESTMENT
13: NEED NOT BE EXPENDED ALL AT ONE TIME
14: CAN BE APPLIED TO OTHER USES IN THE SCHOOL

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ACTIVITY LIST FOR PROJECT COG IMPLEMENT

| ACTIVITY | DURATION | NAME/DESCRIPTION ... |
|---|---|---|
| 0 | 0.0 | START OF PROJECT |
| 1 | 1.0 | IDENTIFY NEED |
| 2 | 10.0 | OBTAIN RECORDS |
| 3 | 30.0 | GET EQUIPMENT |
| 4 | 5.0 | TRAIN TUTOUR |
| 5 | 2.0 | TRAIN STAFF |
| 6 | 0.0 | END OF PROJECT |

PREDECESSOR LIST FOR PROJECT COG IMPLEMENT

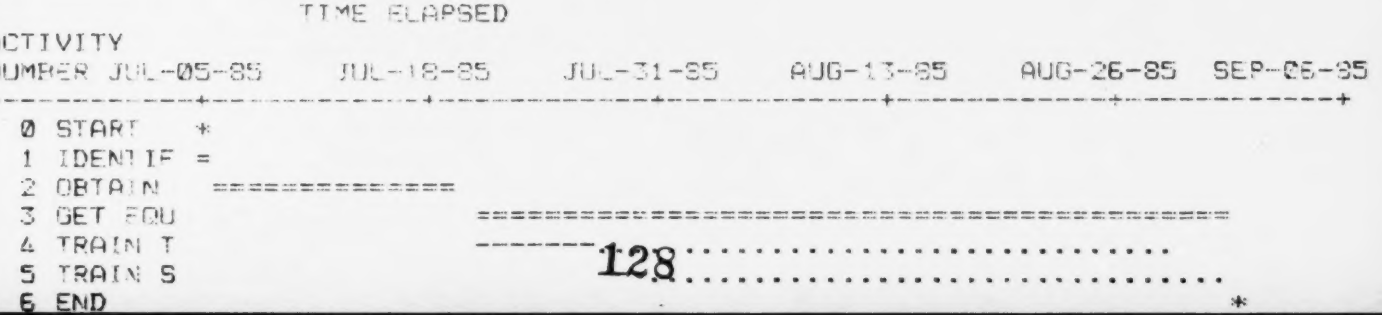
| # | ACTIVITY | PRECEDING ACTIVITIES... |
|---|---|---|
| 1 | IDENTIF | 0 |
| 2 | OBTAIN | 1 |
| 3 | GET EQU | 2 |
| 4 | TRAIN T | 2 |
| 5 | TRAIN S | 4 |
| 6 | END | 3 5 |

SCHEDULE FOR PROJECT COG IMPLEMENT
(DAYS)

| ACTIVITY NUMBER | ACTIVITY | ACTIVITY DURATION | ACTIVITY START: EARLY START | ACTIVITY START: LATE START | ACTIVITY FINISH: EARLY FINISH | ACTIVITY FINISH: LATE FINISH | ACTIVITY SLACK: TOTAL SLACK | ACTIVITY SLACK: FREE SLACK |
|---|---|---|---|---|---|---|---|---|
| 0 | START | 0.0 | JUL-05-85 | JUL-05-85 | JUL-05-85 | JUL-05-85 | 0.0 | 0.0 |
| 1 | IDENTIF | 1.0 | JUL-05-85 | JUL-05-85 | JUL-08-85 | JUL-08-85 | 0.0 | 0.0 |
| 2 | OBTAIN | 10.0 | JUL-08-85 | JUL-08-85 | JUL-22-85 | JUL-22-85 | 0.0 | 0.0 |
| 3 | GET EQU | 30.0 | JUL-22-85 | JUL-22-85 | SEP-02-85 | SEP-02-85 | 0.0 | 0.0 |
| 4 | TRAIN T | 5.0 | JUL-22-85 | AUG-22-85 | JUL-29-85 | AUG-29-85 | 23.0 | 0.0 |
| 5 | TRAIN S | 2.0 | JUL-29-85 | AUG-29-85 | JUL-31-85 | SEP-02-85 | 23.0 | 23.0 |
| 6 | END | 0.0 | SEP-02-85 | SEP-02-85 | SEP-02-85 | SEP-02-85 | 0.0 | 0.0 |

(THE SCHEDULE TAKES INTO ACCOUNT ALL DURATION CHANGES)

TIME CHART FOR PROJECT COG IMPLEMENT



EXPLANATION OF SYMBOLS:

```
*     START AND FINISH (DURATION Ø)
===   DURATION OF CRITICAL ACTIVITIES
---   DURATION OF OTHER ACTIVITIES
...   SLACK OF OTHER ACTIVITIES
```

## QUICK REFERENCE

ACTIVITY LIST: includes all the activities which compose the project and the duration of each activity.

PREDECESSOR LIST: defines the order in which activities must be accomplished.

SCHEDULE: is calculated on the basis of the information contained in the Activity List and the Predecessor List. For each activity, it shows the possible Start and Finish dates (both early and late), as well as the slack time.

SCHEDULED COMPLETION DATE: date at which the project will be completed. Because of the critical activities, the project cannot be completed any earlier.

CRITICAL ACTIVITIES: the bottlenecks with respect to the completion time of the project -- any delay in completing a critical activity will delay the whole project by the same amount. They have the same Early and Late Start dates, and Total Slack of zero.

EARLY START: the earliest date at which an activity can be started given the constraints imposed by the Predecessor List.

EARLY FINISH: the date at which an activity will be finished if it is started at its Early Start date.

LATE START: the latest date at which an activity can start without delaying the Scheduled Completion Date of the project. Only non critical activities have a different Early and Late Start date.

LATE FINISH: the latest date at which an activity can be finished without delaying the Scheduled Completion Date.

TOTAL SLACK: the amount of extra time available to complete an activity without delaying the Scheduled Completion Date. All non critical activities have some Total Slack.

FREE SLACK: the amount of extra time available to complete an activity without delaying any of the following activities -- even if they are scheduled to begin at the Early Start date. Free Slack is always less than or equal to Total Slack.

TIME CHART: graphically represents the Schedule on a calendar like bar chart. The horizontal axis is ruled according to time, and activity numbers are listed on the vertical axis.

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deficits that may require a note-taker or tape recorder. Allowance should also be made for the student to simply get up and leave when necessary. This may be due to stress or the need for therapy, or toileting needs, none of which the student may wish to openly discuss during a class.

In spite of mainstreaming, the student will probably require some resource room support, and that should be scheduled in as needed.

-Various therapy services --

Physical, occupational, speech-language therapy may also have to be allowed for during the student's day.

-Costs --

The obvious costs all lie in initial outlays. The computer, peripherals and software all cost, but with increasingly mandated computer education and educational discounts, the money is somehow found for all the computer classes and is not all that much.

Staff training will certainly be an expense, but exept for an annual re-meeting, it will become self-perpetuating.

Training for the primary tutor will also cost.

-Peer support

Over and over again, disabled students' experiences in public schools have ended in disaster because of the social isolation they are met with. It is imperative that the head-injured student meet at least weekly with a peer group of other disabled students.

Able-bodied students should not be included in this group, but there should also be a group meeting with able-bodied students as well.

An effort--and it will be an effort, must be made to integrate the student into normalcy with his peers. Unfortunately, the experience is that the kids will not initiate this integration themselves, so it is up to the school staff to foster, manipulate and enhance this integration, by whatever means necessary. If this is not done, then there really is no sense in having the head-injured student come to the school in the first place.

-Safety and liability --

This author can say rather little about the legalities of these important issues. What must be noted, however, is that the school must be willing to permit the recovering head-injured students to take the risks of progress and allow for the inconveniences of poor mobility or falls. For the student is not just a risk-taking adolescent, but a risk-taking patient on the road to community re-entry.

The school is a community--the community within which the head injured must achieve reintegration. If the community will not accept its former member, then no matter what the progress of recovery, the person will be stunted and the community will suffer, not only ideologically but economically. A community that will not support its own members loses that community and becomes a self-indulgent rabble. One that will not allow re-training and re-entry will pay to maintain the victim in amounts far greater than the outlays for remedial projects.

The school as community will enrich itself and serve its own highest interest in re-integrating its own head-injured students. But the school must act as community--not simply offer an isolated program. Staff and peer training is of critical importance. Without it, one might not even bother.

XV. Discussion:

If the necessity of implementing such programs within our public schools is realized, the question of its practicability remains. Is it possible? Do the schools have to hire professionally trained cognitive therapists and other staff, and expend uncontrollable amounts of money on electronic gadgetry, all for one or two students who now look, walk and talk funny, and who may someday fall and sue the school system?

Yes, indeed, it is possible and may soon even become mandatory to re-enter our head-injured youth via our public educational facilities. There will always be a place in private settings for the adult head-injured and for those unable to return to school for one reason or another.

The answer to the second question lies in sensitivity and training and in the recognition of the school as a community and a microcosm of the larger community. There are no professionally trained cognitive therapists--only professionals in various clinical areas who have had their own sensitivites raised and have felt the need to create a clinical approach with new technologies.

Again, with respect to money, it should be obvious that school district upon school district is rushing madly to obtain networked arrays of computers for their 'normal' children. Also, all too obvious, is the crush of computer manufacturers to provide the schools with many cheap (sometimes free) computer systems. Given the way the majority of these systems are being used in the schools, one used for the head-injured will probably not be missed.

Within the above statements must be noticed signs of mistrust with regard to the ability of the schools to realize such programs. This hesitancy stems from a long history of disaster upon catastrophe for the disabled in the public school "mainstreamed" population. For little kids this "mainstreaming" appears to work well, but as the child becomes an adolescent, the entire situation changes. The disabled person is left alone, behind, angry and frustrated in his/her attempts to grow along with everyone else.

This situation is not necessary nor inevitable. Its alteration depends upon openness, acceptance and sensitivity. And these in turn depend upon familiarity and training. These realities must be faced and delt with if any program for a disabled person is to do any good within a public institution.

Such a cognitively-based retraining program could and should be implemented within individual schools. The reality has been, however, for the school systems to establish collaboratives and centralize the treatment of its disabled in these facilities. Perhaps this is possible with head injury programs, with the realization that the head-injured constitute a truly unique group of people. They remember what they were like pre-trauma; they are recovering, and the amount of recovery is unknown, so their outcomes cannot be predicted. Given these facts, collaboration is a possibility, but probably not a necessity.

What is necessary is a change in attitude--something certainly not beyond our ability and grasp. And again, if this is not likely to happen, as I said before, one might not even

bother, for it will inevitably lead to disaster and more heartbreak.

This report has been written in clear expression of two point of view. The first is a blatant advocacy for the appropriate and sensitive treatment of head-injured youth. This viewpoint has developed not only from clinical work with these students, but from much work with families and schools.

The second point of view regards the nature of cognition. Put succinctly, it is the claim of this author that thought is not an isolable group of discrete functions, but rather an associative, syncretic-holographic system, if you will, and that this system is based on skills that can be exercised and developed, and indeed retrained after injury.

A knee may never be 100 per cent heeled after injury and surgery, as the brain may not be, but neither is a reason for denial of participation or denial of hope.

It is in the spirit of this hopefulness that this project has been assumed and this report written. New technologies often bring about values, re-thinking and clarification along with new capabilities. It is to be firmly hoped that this technology and this re-thinking will allow the head-injured student to re-enter his world in the right place-- in his/her own community and school.

## XVI. Summary:

This report represents the work of seven months with nine head-injured students at the Cotting School for Handicapped Children, Boston, Massachusetts. The goal of the project has been to consider and design a computer-based cognitive re-training program that could be implemented for head-injured adolescents in the public school systems of the Commonwealth.

In presenting the recommendations of this project, significant attention has been place on : 1) the behavioral, intellectual sequelae of head injury, 2) the hardware requirements of an implemented program, 3) software possibilities and applications, 4) case histories illustrating clinical operation of such a program, and 5) an integrated approach to the development of a cognitive therapy protocol that can serve as a guide to creation of such programs within the public school setting. Lastly, the need for values and sensitivity examination and training has been stressed for satisfactory implementation.

## The "program"

Every student,no matter what his history, encounters the following:

Each comes with a medical history and a neuropsychological evaluation along with any other relevant history.

Each enters a variable period of acquaintance and mutual adaptations to the computer with respect to motoric and cognitive functioning and to baseline establishing.

Each proceed with an individualized program integrating the four components of the therapeutic path: stress management, perceptual skills, conceptual skills and group work. These activities are combined around the weekly schedule, intermingled within seesions and presented as needed.

Each has a session log maintained by the therapis.

Each maintains a personal session journal on disk.

Each maintains a file of data disks as appropriate to programs being used.

Each is helped to recognize that a primary goal is to advance from receiving more cures during activities to fewer cues.

Each is helped to realize the movement from skill-specific activities to more associative, integrated skill activities.

Each is encouraged to recognize the importance of each activity to dealing with real world situations. This last point cannot be stressed enough, particularly for adolescents who are very sensitive to condescension, "game" playing and "busy work" activities.

## Selected Software and Informational Sources:

Calmpute --

Thought Technology, Ltd.
2180 Belgrave Ave.
Montreal, P.Q.
Canada H4A2L8

Relax --

Synapse Software
5221 Central Ave.
Richmond, CA 94804

Apple Pilot/Super Pilot

Apple Computer, Inc.
Cupertino, CA 95014

Apple Logo

Apple Computer, Inc.

Terrapin Logo

Terrapin, Inc.
Cambridge, MA 02139

I.O. Silver

Beagle Bros. Software, Inc.
San Diego, CA 92110

Public Domain Educational Software --

Educational Computing Network
P.O. Box 8236
Riverside, CA 92515

Soft Tools

Cognitive Rehabilitation
P.O. Box 29344
Indianapolis, IN 46229

Word Memory Program --

Bell & Howell
Instructional/Communications Technology
Chicago, IL 60645

Think Fast --

Brainpower, Inc.
24009 Ventura Blvd.
Calabasas, CA 91302

Chipwits --

Brainpower, Inc.

The Lost R - Reasoning --

MCE, Inc.
157 S. Kalamazoo Mall
Kalamazoo, MI 49007

Project Planner --

Applitech Software, Inc.
381 Harvard St.
Cambridge, MA 02138

SunDog --

F.T.L. Games, Inc.
7907 Ostrow St.
Ste. F
San Diego, CA 92111

Sunburst software --

Sunburst Communications
39 Washington Ave.
Pleasantville, NY 10570

Skyfox --

Electronic Arts
2755 Campus Drive
San Mateo, CA 94403

Bank St. Writer --

Scholastic, Inc. &
Bank St. College of Education
New York, NY

Robot Odyssey --

The Learning Company
Menlo Park, CA 94025

Peripherals:

Koala Pad --

Koala Technologies Corporation
3100 Patrick Henry Dr.
Santa Clara, CA 95050

Adaptive Firmware Card --

Adaptive Peripherals
4529 Bagley Ave. N.
Seattle, WA 98103

Print-It --

Texprint, Inc.
Needham Heights, MA 02194

Presfax 100 Keypad --

S&S Software
Schofield and Sims, Ltd.
Huddersfield, England

Reading:

Write Your Own Apple Games

Stuart Anstis
Creative Computing Press
Morris Plains, N.J.
Source of Peggy and many others.

Closing the Gap

Henderson, MN 56044
the best source of information about computers and the disabled. Newspaper format every couple of months.

Cognitive Rehabilitation

6555 Carrolton Ave.
Indianapolis, IN 46220
articles written for therapists and families of head-injured. Source of public domain Soft tools.

Other:

Subscribe to one or more of the popular computing magazines--more for the ads than anything else. For one can obtain much soft- and hardware at very reasonable prices through mail order.

Join a computer user's group, such as the Boston Computer Society, not only for knowledge, but for access to much public domain software, which is distributed through these groups.

Join the growing number of special education computer user groups forming around the Commonwealth. Many are supported and fostered by the Regional Education Centers located around Massachusetts.

Look carefully through the masses of public domain software available, for you can find many programs that are both valuable and very cheap or free to use.

The Following Bibliography
Is Provided By The Courtesy
Of The
National Head Injuries Foundation

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# A SELECT BIBLIOGRAPHY

# TRAUMATIC HEAD INJURY REHABILITATION

# IN ADOLESCENTS AND ADULTS

Ms. Deborah A. Lane, M.O.T.
June 1984

COMPLIMENTS OF:

National Head Injury Foundation, Inc.
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Baum, B. A., & Meeder, D. L. Head injury in adults. In L. W. Pedretti (Ed.). Occupational therapy practice skills for physical dysfuction. St. Louis: The C. V. Mosby Company, 1981, pp. 296-320.

Collins, W. F., Jr., Venes, J. L., Wagner, F. C., Jr., & Spencer, D. D. Neurologic surgery. In S. I. Schwartz (Ed.). Principles of surgery (3rd ed.). New York: McGraw Hill Book Co., 1979.

Hawken, M.,& Ozuma, J. Practical aspects of anticonvulsant therapy. American Journal of Nursing, June 1979, pp. 1062-1068.

Hopkins, H. L., & Smith, H. D. (Eds.). Willard and spackman's occupational therapy (5th ed.). Philadelphia: J. B. Lippincott Company, 1978, p. 729.

Jennett, B., & Teasdale, G. Management of head injuries. Philadelphia: F. A. Davis Co., 1981.

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Kindt, G. W., & Gosch, H. H., Trauma to the central nervous system. In C. F. Frey (Ed.). Initial management of the trauma patient. Philadelphia: Lea and Febiger, 1976, pp. 241-254.

Lewin, W., Marshall, T. F. de C., & Roberts, A. H. Long-term outcome after severe head injury. British Medical Journal, 1979, 2, 1533-1538.

Meyd, C. J. Acute brain trauma. American Journal of Nursing, January 1978, pp. 40-43.

Nardi, G. L. (Ed.). Surgery: a concise guide to clinical practice. (3rd ed.). Boston: Little, Brown and Co., 1972, pp. 905-911.

National Head Injury Foundation, Inc. The silent epidemic. Framingham, Massachusetts, 1980.

Weber, P. L. Closed head injuries. In C. A. Trombly (Ed.), Occupational therapy for physical dysfunction (2nd ed.). Baltimore: Williams & Wilkins, 1983, pp. 336-347.

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Kalsbeek, W. D., McLaurin, R. L., Harris, B. S. H., & Miller, J. D. The national head and spinal cord injury survey: Major findings. Journal of Neurosurgery, 1980, 53, S19-S31.

Presents major findings and estimates of frequency of existing cases, occurrence of new cases, and economic costs to head and spinal cord injured clients in the U.S. in 1974. Also presents estimates for subpopulations based on demographic variables.

Kraus, J. F. A comparison of recent studies on the extent of the head and spinal cord injury problem in the United States. Journal of Neurosurgery, 1980, 53, S35-S43.

Describes a study in which findings from the National Head and Spinal Cord Injury Survey are compared with findings from other epidemiologic studies in the U. S. Findings state that comparing methodological approaches and results will provide a baseline for future studies.

Kraus, J. F. Injury to the head and spinal cord. Journal of Neurosurgery, 1980, 53, S3-S10.

Reviews the medical literature published in English from January 1960 through June 1978. Focuses on head injury morbidity measures and economic costs. Findings indicate definitions, terms, and research methods lack uniformity.

Rimel, R. W. A prospective study of patients with central nervous system trauma. Journal of Neurosurgical Nursing, 1981, 13, 132-141.

Describes a prospective, clinical research project with major emphasis on head injured patients in developing a data bank. This helps identify the population at risk for trauma, treatment guidelines, and outcome.

MEDICAL

Bowers, S. A., & Marshall, L. F. Severe head injury: Current treatment and research. Journal of Neurosurgical Nursing, 1982, 14, 210-219.

Reviews head injured patient care from time of injury through intensive care unit. Lists current initial Triaze neurological assessment that is done in less than two minutes, compares Maryland Coma Scale with Glasgow Coma Scale, and explains standard head injured adult management procedures and positioning.

Feiring, E. H. Management of head injuries. Comprehensive Therapy, 1979, 5(1), 53-58.

Details head injured patient care with emphasis on comatose condition. Secondary effects such as intracranial hemorrhage, infection, carotid cavernous fistula, posttraumatic epilepsy, posttraumatic hydrocephalus, liptomeningeal cysts, and postconcussion syndrome are discussed.

Gilmor, R. L. Computerized axial tomography in head trauma. Critical Care Quarterly, 1979, 2(1), 61-66.

Explains diagnostic use of computerized axial tomography. Presents scans of acute subdural hematoma, epidural hematoma, isodense subdural hematoma, and chronic subdural hematoma with detailed explanations. Findings reveal contrast enhancement series of scans in the acute head injured patient are not of significant value. They can be used in follow-up and evaluation of nonacute head injured.

Parkinson, J. The ballistics of craniocerebral gunshot wounds. Journal of Neurosurgical Nursing, 1982, 14, 232-238.
Presents thorough explanation on how a bullet causes head injuries, missile wounds, and complications. Diagrams are shown for further understanding of the wound to insure correct treatment plan.

Rimel, R. W., & Tyson, G. W. The neurologic examination in patients with central nervous system trauma. Journal of Neurosurgical Nursing, 1979, 11, 148-155.
In-depth discussion of neurologic history and examination approach to multidisciplinary treatment program. External signs of cranial trauma, memory function, consciousness levels, focal and lateralizing neurologic signs, vital signs, and restlessness are presented. Also discusses diagnostic tests that are not recommended for head injured patients.

Roberts, J. R. Pathophysiology, diagnosis and treatment of head trauma. Topics in Emergency Medicine, 1979, 1(1), 41-62.
Summarizes standard procedures emergency department clinicians utilize on head trauma patients. Includes sections on specific injuries, diagnosis, and treatment.

Rose, J., Valtonen, S., & Jennett, B. Avoidable factors contributing to death after head injury. British Medical Journal, 1977, 2, 615-618.
Presents study of 116 patients who talked before dying from head injury. Delay in intracranial hematoma treatment is most common avoidable factor. Findings show need for review of head injured care in acute stage.

## ASSESSMENT

Eson, M. E., Yen, J. K., & Bourke, R. S. Assessment of recovery from serious head injury. Journal of Neurology, Neurosurgery, and Psychiatry, 1978, 41, 1036-1042.

Describes a four segment developmental scale with tests appropriate for each recovery level to be used from coma recovery to full recovery or plateau level lasting three months. A case history with recovery curves is presented. Findings show head injured patients regain context free responses before they can apply these in situations. Adaptive functioning is rapid at onset after coma, but slows down drastically.

Frowein, R. A. Prognostic assessment of coma in relation to age. Acta Neurochirurgica, 1979, 28(1), 3-12 (Supplement).

Provides detailed assessment graphs and charts of four stages of coma. Findings show coma duration assessed with patient age are main factors determining survival. Unfavorable outcome prediction and early prognosis established only for patients in deep coma IV stage for more than four hours in all age groups.

Gronwall, D. M. A. Paced auditory serial-addition task: A measure of recovery from concussion. Perceptual and Motor Skills, 1977, 44, 367-373.

Discusses paced auditory serial-addition task for rate of information processing in measuring for concussion severity. Presents rehabilitation management of concussion patients with test results showing rate and progress degree during recovery period.

Harvey, R. F., & Jellinek, H. M. Functional performance assessment: A program approach. Archives of Physical Medicine and Rehabilitation, 1981, 62, 456-461.
Presents Patient Evaluation Conference System as a functional assessment in team rehabilitation to guide treatment, assess program effectiveness, and establish specific patient goals. An effective eight point system is outlined with results of 125 patients' evaluations tabulated to show progress toward specific functional goals.

Isamat, F., Bartumeus, F., & Asins, I. Protocol for reception, management, and assessment of head injuries. Acta Neurochirurgica, 1979, 28(1), 17-25 (Supplement).
Provides examples of standardized Head Injured Protocol Chart that include: reception, examination, and observation sections. Patient evaluation can be reviewed at any moment by any staff member.

Jones, C. Glasgow coma scale. American Journal of Nursing, 1979, 79, 1551-1553.
In-depth description and pictorial presentation of Glasgow Coma Scale. Assessment of eye opening, verbal response, and best motor response are discussed.

Jones, C. Monitoring recovery after head injury: Translating research into practice. Journal of Neurosurgical Nursing, 1979, 11, 192-198.
Presents thorough descriptions of Glasgow Coma Scale, five level Glasgow Outcome Scale, and Galveston Orientation and Amnesia Test. These, with other information, can predict probable outcome in early stages of in-patient care and permit team members to choose appropriate goals.

Rappaport, M., Hall, K. M., Hopkins, K., Belleza, T., & Cope, D. N. Disability rating scale for severe head trauma: Coma to community. Archives of Physical Medicine and Rehabilitation, 1982, 63, 118-123.

Outlines Disability Rating (DR) Scale that assesses eight items divided into four categories of head trauma disabilities. Arousal and awareness, cognitive ability for self-care, physical dependence, and psychosocial adaptability for work, school, or housework categories follow patient from coma to community. A low score reflects low disability as it is easier to identify impairment level than wellness level. DR Scale selects hospitalized patients who are appropriate candidates for limited bed rehabilitation units.

Seales, D. M., Rossiter, V. S., & Weinstein, M. E. Brainstem auditory evoked responses in patients comatose as a result of blunt head trauma. Journal of Trauma, 1979, 19, 347-353.

Evaluates brainstem auditory evoked response (BAER) procedure used on 17 comatose blunt head injured patients. Results indicate BAER useful for early diagnosis and prognosis in comatose patients.

Teasdale, G., Murray, G., Parker, L., & Jennett, B. Adding up the Glasgow Coma Score. Acta Neurochirurgica, 1979, 28(1), 13-16 (Supplement).

Outlines Glasgow Coma Scale (GCS) assessment in chart and graph presentations. Findings show each response of three separate responses: eye opening, verbal, and motor at any time are closely related to outcome. Also states the GCS should be supplemented with other dysfunction information for thorough assessment.

Yen, J. K., Bourke, R. S., Nelson, L. R., & Popp, A. J. Numerical grading of clinical neurological status after serious head injury. Journal of Neurology, Neurosurgery, and Psychiatry, 1978, 41, 1125-1130.

Presents the Head Injury Watch Sheet with categories of: consciousness and mental status, motor response to pain, and pupillary reaction to be used from first evaluation to achievement of personal self-care. Two representative cases are included with appropriate graphs.

## GENERAL REHABILITATION

Bond, M. R. Head injuries symposium: The stages of recovery from severe head injury with special reference to late outcome. International Rehabilitation Medicine, 1979, 1(4), 155-159.

Defines, with use of tables, three recovery stages: comatose, posttraumatic amnesia ending with awareness resurfacing, and adaptation to residual disabilities. Also presents table, with discussion, outlining rehabilitation methods in recovery stages.

Cope, D. N., & Hall, K. Head injury rehabilitation: Benefit of early intervention. Archives of Physical Medicine and Rehabilitation, 1982, 63, 433-437.

Describes a study of severe head injured patients in an acute rehabilitation setting grouped according to early and late admissions. Patients were followed for two years post injury. Results indicate reduced hospitalization length and cost with early admission to intensive rehabilitation programs with occupational therapy programs from acute medical surgical wards.

DeVilliers, J. C. Barriers to rehabilitation of the head-injured patient. South African Medical Journal, 1981, 60, 845-848.

Presents obstacles that interfere in the rehabilitation process of head-injured patients. These barriers are discussed under the major categories of physical disability, personality, intellectual and emotional factors, and environmental factors.

Evans, C. D., & Bull, C. P. I., Devonport, M. J. & Hall, P. M., Jones, J., Middleton, F. R. I., Russell, G., Stichbury, J. C., & Whitehead, B. Rehabilitation of the brain-damaged survivor. Injury: the British Journal of Accident Surgery, 1977, 8, 80-97.

Comprehensive article details assessments, evaluations and examinations of physicians, educators, occupational, speech, and physical therapists of 121 traumatic brain injured patients. Recovery curves as indicators of effectiveness of long term therapy are suggested. A comprehensive head injury reference list is included.

Hale, S., & Stephens, S. E. Neurological treatments...head injured patients. Physiotherapy, 1983, 69, 72-75.

Describes mobile apparatus usage introduced by the Bobaths that was used in three case studies of severe head injured patients. Includes pictures and diagrams of patients in treatment using the Bobath ball.

Jones, R., Giddens, H., & Croft, D. Assessment and training of brain-damaged drivers. American Journal of Occupational Therapy, 1983, 37, 754-760.

Presents a study of 300 brain-damaged patients after hospital discharge who were enrolled in a driving assessment and training program. Describes the following off road tests: visual, reaction timing, preview tracking task, and general medical and psychological appraisal. Discusses the advantages of the occupational therapist in the role of initial driver trainer.

Kerley, J. Improvement in arm and hand function following head injury: A single case study. Physiotherapy, 1982, 68, 74-76.

Using the A-B-A-B design, an 18 year old head injured patient was treated for spasticity using Bobath techniques to increase ROM, quality of voluntary movement, and decrease spasticity in his right upper extremity. A represents "treatment phase" and B represents "no treatment." Occupational therapy treatment is presented. Results indicate improvement and treatment effects through all four phases, especially in arm movement and wrist extension.

Lezak, M. D. Subtle sequelae of brain damage: perplexity, distractability and fatigue. American Journal of Physical Medicine, 1978, 57, 9-15.

Discusses perplexity, distractability, and fatigue as underlying problems of brain injured clients. Recommendations for clinical and family approaches to these difficulties are given.

Lynch, W. J., & Mauss, N. K. Brain injury rehabilitation: Standard problem lists. Archives of Physical Medicine and Rehabilitation, 1981, 62, 223-227.

Presents a standard problem list used in brain injury rehabilitation units with problem oriented medical records. Major categories listed are further broken down into sequence and terms are: cognitive problems, sensory motor problems, medical conditions, emotional problems, and social problems.

Miller, E. The training characteristics of severely head-injured patients: A preliminary study. Journal of Neurology, Neurosurgery, and Psychiatry, 1980, 43, 525-528.

Eight head-injured patients were matched with a control group of neurologically normal subjects to investigate learning and transfer of training characteristics using the Minnesota Spatial Relations Test. Results indicate increased learning skills in the head injured group with training. Further questions are posed which address clinical practice in rehabilitation based on the findings of this study.

Morgenstein, S., & Brown, E. Improving ambulation in long-term brain-injured adults: A clinical study. Physiotherapy Canada, 1978, 30, 70-74.

Describes a study in which Fay, Doman and Delacato treatment theories are the basis for treating 14 brain-injured adults utilizing a developmentally based therapeutic exercise program and sensorimotor bombardment of the brain to improve ambulation. During treatment sessions, ambulation was prevented. Results indicate significant improvement after treatment program was completed.

Panikoff, L. B. Recovery trends of functional skills in the head-injured adult. American Journal of Occupational Therapy, 1983, 37, 754-760.

Reviews functional skills study of 80 head injured adults who were rated at two, four, six, 12, and 24 months post injury. Discusses use of basic ADL, functional transfers, Jebsen hand function, community skills, wheelchair mobility, dressing, kitchen skills, and basic hand function test as occupational therapy variables to use for setting goals and therapy time estimates. Findings show impairment ratings for the long-coma group were higher with more variables than the short-coma group.

Stitchbury, J. C., Davenport, M. J., & Middleton, F. R. I. Head-injured patients-a combined therapeutic approach. Physiotherapy, 1980, 66(1), 288-292.

Discusses the success and expansion of team approach in treatment of four head-injured patients who had lost sequencing abilities. Findings reveal a basic pattern in one situation must be taught very thoroughly before adapting it to other uses. Therapy showed deficits in input processing rather than output responses.

Stride, B. Computers and the severely physically handicapped: A pilot project at Pearson Hospital. Canadian Journal of Occupational Therapy. 1982, 49, 125-128.

Discusses the use of the computer as a typewriter, programming device, and a word processor adapted to severely handicapped clients. Includes an assessment to guide occupational therapists when evaluating a patient's potential for computer use.

Tanhehco, J., & Kaplan, P. E. Physical and surgical rehabilitation of patient after 6-year coma. Archives of Physical Medicine and Rehabilitation, 1982, 63, 36-39.

Presents a case report of a head injured patient who responded to environmental stimuli after six years' coma. He then progressed through a 14 month intensive rehabilitation program before returning home to live with his family.

Timming, R. C., Cayner, J. J., Grady, S., Grafman, J., Haskin, R., Malec, J., & Thornsen, C. Multidisciplinary rehabilitation in severe head trauma. Wisconsin Medical Journal, 1980, 29(2), 49-52.

Describes a 50 year old head injured patient with severe cognitive, physical, and interpersonal deficits in a multidisciplinary rehabilitation program. Occupational therapy assessments, treatment goals, and results are mentioned. Article states that using a multidisciplinary approach may improve quality of life.

## COGNITIVE ASPECTS

Baum, B., & Hall, K. M. Relationship between constructional praxis and dressing in the head-injured adult. American Journal of Occupational Therapy, 1981, 35, 438-442.

Presents study of 37 severe head-injured patients who were rated on constructional praxis using three constructional praxis measures and dressing skills to explore relationships between the two. A significant correlation between constructional praxis and dressing is present. Findings suggest a portion of the inability to dress is perceptual, not motor in origin.

Ben-Yishay, Y., & Diller, L. Rehabilitation of cognitive and perceptual defects in people with traumatic brain damage. International Journal of Rehabilitation Research, 1981, 4, (2), 208-210.

Authors propose systematic intervention programs consisting of three major components: cognitive remediation, group approach exercises, and community activities. Results of the first 13 trainees who completed phase one are examined. Findings indicate performance improved on tasks involving attention, concentration, and interpersonal skills.

Brooks, D. N., Aughton, M. E., Bond, M. R., Jones, P., & Rizvi, S. Cognitive sequelae in relationship to early indices of severity of brain damage after severe blunt head injury. Journal of Neurology, Neurosurgery, and Psychiatry, 1980, 43, 529-534.

Describes a study of 89 severe head injured patients who were psychologically tested to determine relationships between test performances and indices of brain damage. Results indicate a significant relationship between posttraumatic amnesia duration and predicted cognitive performance. No significant relationship is shown between duration of coma and later cognitive outcome.

Brooks, D. N., & Aughton, M. E. Head injuries symposium: Cognitive recovery during the first year after severe blunt head injury. International Rehabilitation Medicine, 1979, 1, 166-172.

Presents study of 24 severe closed head injured patients who were tested at three, six, and 12 months after injury for cognitive recovery. Patients' intelligence, learning, memory, language, perceptual, and constructional skills were tested with a control group of retested non-head injured. Findings note a statistically significant difference between control group and head injured patients at 12 months on learning and constructional skills.

Cravitz, H. F. Memory retraining in brain-damaged patients: The airplane list. Cortex, 1979, 15, 131-134.

Discusses use of the airplane list to encourage deep and elaborate encoding of words on two brain-damaged patients. Initially, both failed to recall all items. With retrieval cues given, both patients showed improvement in recall.

Giantsos, R. What is cognitive rehabilitation? Journal of Rehabilitation, 1980, 46(3), 36-40.

Describes cognitive rehabilitation, presents a comprehensive case study, and applies cognitive rehabilitation to various examples. These include safety in activities of daily living and small computer use. The cognitive rehabilitation specialist is defined.

Glasgow, R. E., Zeiss, K. A., Barrera, M., & Lewinsohn, P. M. Case studies on remediating memory deficits in brain-damaged individuals. Journal of Clinical Psychology, 1977, 33, 1049-1054.

Two in-depth case studies on individuals with brain damage caused by motor vehicle accidents are presented which apply mnemonic techniques for remediation of memory problems. Assessment, evaluation, intervention strategies, and application are included. The article stresses the need of therapists to address these areas.

Kear-Colwell, J. J., & Heller, M. The Weschler memory scale and closed head injury. Journal of Clinical Psychology, 1980, 36, 782-787.

Presents study of 70 head injured patients who were compared with 116 normal individuals using the Wechsler Memory Scale and subtests of Logical Memory and Associate Learning. Factor analysis of test results indicate younger head injured clients had very severe memory deficits compared to less impairment of the older head injured group. Greatest losses are shown in verbal learning and immediate recall.

Levin, H. S., O'Donnell, V. M., & Grossman, R. G. The Galveston orientation and amnesia test. A practical scale to assess cognition after head injury. Journal of Nervous and Mental Disease, 1979, 167, 675-684.

In-depth discussion of Galveston Orientation and Amnesia Test (GOAT) for head injured cognition. Results of daily scoring show serial GOAT scores are directly related to severity of traumatic head injury and long-term outcome.

Schacter, D. L., & Crovitz, H. F. Memory function after closed head injury: A review of the quantitative research. Cortex, 1977, 13, 150-176.

Reviews the literature on memory functioning after closed head injury. Posttraumatic amnesia (PTA) criteria for posttraumatic amnesia assessment, PTA duration, relation of duration to later memory impairment, memory functions, and comparison between PTA and other amnesic conditions are listed. Suggestions are given for future PTA research. 106 references are listed.

## FUNCTIONAL COMMUNICATION

Groher, M. Language and memory disorders following closed head trauma. Journal of Speech and Hearing Research, 1977, 20, 212-223.

Reviews disorders of 14 closed head injured patients. Study using Porch Index of Communicative Ability indicates gestural language skills to be worst deficit in first test after regaining consciousness but improves steadily to fourth month. Patient management includes constant cueing with delayed and distorted patient responses. Wechsler Memory Scale results indicate orientation section as most difficult tasks after four months post coma. Findings show confused language skills may be separate from aphasic language deficits.

Levin, H. S., Grossman, R. G., Sarwar, M., & Meyers, C. A. Linguistic recovery after closed head injury. Brain and Language, 1981, 12, 360-374.

Presents linguistic recovery study of 21 aphasic head injured patients with relation to location, extent and type of injury. Computerized cranial tomography scans show relationship of injury severity to language disturbance profile. Findings show specific deficits as expressive language and especially naming. Full aphasia recovery is noted in patients with hematoma in either hemisphere.

Najenson, T., Sazbon, L., Fiselzon, J., Becker, E., & Schechter, I. Recovery of communicative functions after prolonged traumatic coma. Scandinavian Journal of Rehabilitation Medicine, 1978, 10, 15-21.

Discusses communication function study of 15 prolonged coma, head injured cases. Study reveals communication recovery can start as late as 5.7 months after injury with recovery patterns comparable to locomotion and activities of daily living. Findings indicate restlessness and sweating to be prognostic indicators for patients about to emerge from coma.

Sarno, M. T. The nature of verbal impairment after closed head injury. Journal of Nervous and Mental Disease, 1980, 168 685-692.

Reviews study of 56 closed head injured patients to determine verbal deficits. Results indicate many patients change aphasia types during recovery. Patients with brain stem lesions show dysarthria and subclinical linguistic deficits through testing. Discusses patient management dealing with linguistic deficits in multidisciplinary rehabilitation setting.

Thomsen, I. V. Neuropsychological treatment and longtime follow-up in an aphasic patient with very severe head trauma. Journal of Clinical Neuropsychology, 1981, 3, 43-51.

In-depth review of head injured aphasic patient reveals global aphasia is main reason for behavior regression. Very slow progression from automatic to intellectual language is due to general improvement of mental abilities. Article notes important rehabilitation procedures contribute to successful patient outcome.

Thomsen, I. V. Verbal learning in aphasic and non-aphasic patients with severe head injuries. Scandinavian Journal of Rehabilitation Medicine, 1977, 9, 73-77.

Describes study which tests auditory verbal memory span, rote learning, learning of unrelated words, and substance recall in aphasic and non-aphasic severe head injured patients and control group. Results indicate aphasics score lower in all tests than non-aphasics and that non-aphasics score significantly lower than control group in every test but substance recall.

Von Cramon, D. Traumatic mutism and the subsequent reorganization of speech functions. Neuropsychologia, 1981, 19, 801-805.

Describes emerging non-verbal utterances and verbal patterns of 11 mute severe head injured patients. Study shows patients did not progress to normal intonation within the first year following injury.

## FEEDING/NUTRITION

Brambilla, G., & Sangiovanni, G. Head injuries: A clinical and instrumental evaluation of a metabolic therapy. Current Therapeutic Research: Clinical and Experimental, 1978, 24, 313-326.

Evaluates treatment of 60 head injured patients with neurohomologous phospholipids vs. placebo. Antiedema therapy was given to both groups resulting in a faster rate of improvement of patients treated with neurohomologous phospholipids.

Ensin, J. Nutritional assessment of a severely head-injured, multi-trauma patient. Journal of Neurosurgical Nursing, 1982, 14, 262-267.

Reviews the aspects of nutritional assessment and provides additional information on nutritional complications of head injury. A case study of a malnourished 17 year old is presented that demonstrates the catabolic stress response.

Hargrove, R. Feeding the severely dysphagic patient. Journal of Neurosurgical Nursing, 1980, 12, 102-107.

Describes the anatomy and physiology of swallowing, specifically emphasizes the deglutition process, presents assessment of cranial nerves that involve dysphasia, and includes a feeding program in which occupational therapy has potential involvement.

Silverman, E. H., & Elfant, I. L. Dysphagia: An evaluation and treatment program for the adult. American Journal of Occupational Therapy, 1979, 33, 382-392.

Reviews the physiology, management, evaluation, and treatment of swallowing disorders applicable to occupational therapy. Four case studies, a feeding evaluation, and treatment guide are included.

## FAMILY ADJUSTMENT

Frye, B. A. Brain injury and family education needs. Rehabilitation Nursing, 1982, 7(4), 27-29.

Brief article describes the importance of educating the families of brain injured adults and involving them in the rehabilitation process.

Jennett, B. If my son had a head injury. British Medical Journal, 1978, 1, 1601-1603.

A physician places himself in a hypothetical situation of having a head injured son and discusses the treatments and rehabilitation process his son would be involved in during recovery. Many questions and issues are raised that may add to reappraisal of current practices.

Lezak, M. D. Living with the characterologically altered brain injured patient. Journal of Clinical Psychiatry, 1978, 6, 592-598.

Comprehensive article discusses common family, children, and spouse problems in living with a brain injured patient. Also discusses family expectations and depression with specific recommendations for dealing with these problems. The role of the counselor, which can be assumed by any experienced clinician familiar with the case is presented.

Mauss-Clum, N., & Ryan, M. Brain injury and the family. Journal of Neurosurgical Nursing, 1981, 13, 165-169.

Discusses the effects of brain injury on the family at the time of injury and long-term effects based on questionnaires which were completed by 30 families. One-half of the brain injured patients were involved in traumatic accidents. Discusses family support group approach and areas for further research.

Oddy, M., Humphrey, M., & Uttley, D. Stresses upon the relatives of head-injured patients. British Journal of Psychiatry, 1978, 133, 507-513.

Head injured patients' families were interviewed at one, six, and 12 months post injury and given the Wakefield Depression Scale to measure degrees of stress on relatives at various stages of patient recovery. Findings show one month post injury as the greatest period of stress for relatives followed by a leveling off period at six months and 12 months. The patient's personality changes are a major stress factor rather than the severity of injuries. Methods of lessening stress are explored.

## PSYCHOSOCIAL ADJUSTMENT

Dikmen, S., & Reitan, R. M. Emotional sequelae of head injury. Annals of Neurology, 1977, 2, 492-494.

Discusses emotional reactions in head injured patients and link between adjustment problems and cognitive intellectual levels of ability. Clinical observations and insight are noted as valuable tools in dealing with posttraumatic behavior.

Dye, O. A., Saxon, S. A., & Milby, J. B. Long-term neuropsychological deficits after traumatic head injury with comatosis. Journal of Clinical Psychology, 1981, 37, 472-477.

Presents conclusions of study involving 48 head injured adults and control group with both groups experiencing coma. Various test scores and data on self-care, work, homemaking, and school functioning levels are discussed. Results indicate subjects with longer coma duration suffer greater functioning deficits that involve motor skills and are less likely to progress to former level of functioning.

Gans, J. S. Hate in the rehabilitation setting. Archives of Physical Medicine and Rehabilitation, 1983, 64, 176-179.

Presents in-depth discussion of hate experienced by patients in rehabilitation setting and how occupational therapists particularly upset patient with self-care and activities of daily living goals. Views suggest ways for bolstering patient self-esteem and for therapists to understand and manage techniques of hate.

Habermann, B. Cognitive dysfunction and social rehabilitation in the severely head-injured patient. Journal of Neurosurgical Nursing, 1982, 14, 220-224.

Focuses on cognitive changes of the head injured patient and those effects on social rehabilitation and reintegration. Reviews studies of posttraumatic amnesia and resulting deficits. Notes the key issues to be quality of life of survivor and the successful rehabilitation of that patient.

Levin, H. S., & Eisenberg, H. M. Neuropsychological impairment after closed head injury in children and adolescents. Journal of Pediatric Psychology, 1979, 4, 389-402.
Discusses results of 64 head injured children and adolescents study. Findings conclude that 50% show memory dysfunction. Impairment was found to be directly related to severity of injury evidenced by coma duration and Glasgow Coma Scale.

Levin, H. S., Grossman, R. G. Behavioral sequelae of closed head injury. Archives of Neurology, 1978, 35, 720-727.
Presents study of 50 head injured patients who were given the Brief Psychiatric Rating Scale of Overall and Gorham to determine behavior disturbances. Findings show greatest disturbance areas are: cognitive disorganization, emotional withdrawal, and motor retardation. Authors note agitation as a contributing factor to prognosis of behavior deficits.

Maki, N. Psychological analyses of brain damage cases. Journal of Biological Psychology, 1978, 29(2), 11-21.
Reviews in-depth experiments of brain injured individual in ability to trace and draw with relation to perception. This visual agnosia patient exhibits separate movement spheres of one hand from the other.

McClelland, P. A. Behavioral problems after closed head injuries. Topics in Emergency Medicine, 1983, 4(4), 42-50.
Presents seven case studies to show head injury behavioral deficits. Discusses personality changes, depression, violent behavior, confusion, and anxiety as most frequent problems. Frequent reorientation, reality testing, recognition assistance, and reassurance concerning fears are mentioned as helpful therapy interventions.

Newcombe, F., & Fortuny, L. A.i. Problems and perspectives in the evaluation of psychological deficits after cerebral lesions. International Rehabilitation Medicine, 1979, 1(4), 182-192.

Presents over view of problems researcher faces in studying psychological deficits of brain injured individuals that have an effect on rehabilitation and prognosis. Author recommends a broader rehabilitation treatment base that includes quality of life and patient equilibrium. Contains extensive bibliography.

Oddy, M., & Humphrey, M. Social recovery during the year following severe head injury. Journal of Neurology, Neurosurgery, and Psychiatry, 1980, 43, 798-802.

Discusses social recovery with findings tabulated at four weeks, six months, 12 months, and two years post injury by interviewing a close relative of 54 head injured patients. Activities of Daily Living Assessment and cognitive tests were given patients as well as symptom check list that was also given relatives. Findings indicate head injured have fewer social outings which suggest motivational problems after hospital discharge. Loneliness is discussed and need for strong family support for rehabilitation efforts to be successful.

Oddy, M., Humphrey, M., & Uttley, D. Subjective impairment and social recovery after closed head injury. Journal of Neurology, Neurosurgery, and Psychiatry, 1978, 41, 611-616.

Presents study of 50 head injured patients to show social adjustments should be more than just return-to-work oriented. Leisure activities, friends, family and marital relationships, parental behavior, and finances are discussed. Most frequent symptoms tabulated are: poor memory, temper loss, and fatigue. Article notes main rehabilitation team challenges are: restlessness, irritability, and impatience in head injured patients.

Reyes, R. L., Bhattacharyya, A. K., & Heller, D. Traumatic head injury: Restlessness and agitation as prognosticators of physical and psychologic improvement in patients. Archives of Physical Medicine and Rehabilitation, 1981, 62, 20-23.

Describes a five year study of 87 traumatic head injured patients in which posttraumatic activity level (PTAL) was evaluated on admission and comparisons made with cognitive and overall status at discharge. Results indicate a significant relationship between PTAL and improvement in physical and cognitive functioning. An inverse relationship is noted between restlessness and agitation and psychological adjustment.

Weddell, R., Oddy, M., & Jenkins, D. Social adjustment after rehabilitation: A two year follow-up of patients with severe head injury. Psychological Medicine, 1980, 10, 257-263.

Reviews two year study of 54 head injured adults and control group for social adjustment. Increased irritability, more affectionate behavior, boredom, family friction, and fewer friendships are discussed. Findings indicate patient and relatives adjust to disabilities during the two year post insult period. Authors note need for better retraining methods and more family support during rehabilitation.

## VOCATIONAL/EDUCATIONAL REHABILITATION

Brennan, M. A. Resumption of work following discharge from hospital. Irish Medical Journal, 1981, 74(1), 5-7.
Presents retrospective survey nine months post discharge on three groups of patients: head injured, myocardial infarctions, and low back pain, to determine work status and contributing factors. Results indicate a significant number failing to return to work. The review of literature states occupational therapist's definite role in the early phases of rehabilitation of head injured patients and that close liason be established between placement, vocational rehabilitation services, and hospital rehabilitation departments.

Humphrey, M., & Oddy, M. Return to work after head injury: A review of post-war studies. Injury: The British Journal of Accident Surgery, 1980, 12, 107-114.
Reviews literature over the past 50 years on head injured patients in their return to productive work.

Jellinek, H. M., & Harvey, R. F. Vocational/educational services in a medical rehabilitation facility: Outcomes in spinal cord and brain injured patients. Archives of Physical Medicine and Rehabilitation, 1982, 63, 87-88.
Describes a study of brain and spinal cord injured patients' treatment before hiring vocational/educational staff compared to outcomes of patients after professional staff was employed. Results indicate patients show dramatic increase in meeting their employment and educational goals with a specialized vocational/educational staff.

Rosenbaum, M., Lipsitz, N., Abraham, J., & Najenson, T. A. description of an intensive treatment project for the rehabilitation of severely brain-injured soldiers. Scandinavian Journal of Rehabilitation Medicine, 1978, 10, 1-6.

Reviews a one year vocational rehabilitation program involving 13 severely brain injured patients in a sheltered therapeutic environment. The three major goals of the program are: changing and modifying behavior, creating a supportive environment, and generalizing the therapeutic effects to the community at large. Results indicate improvement in performance while patients are in a sheltered therapeutic setting.

Weiss, L. Vocational evaluation: An individualized program. Archives of Physical Medicine and Rehabilitation, 1980, 61, 453-454.

Brief article presents a case study utilizing an individualized vocational evaluation instead of standardized tests for a brain injured patient with language impairment. Evaluating vocational potentials of brain injured patients is most valid when utilizing a work setting as an evaluation site.

## PATIENT OUTCOME

Braakman, R., Gelpke, G. J., Habbema, J. D. F., Maas, A. I. R., & Minderhoud, J. M. Systematic selection of prognostic features in patients with severe head injury. Neurosurgery, 1980, 6, 362-370.

Presents study of 305 head injured patients whose case histories are in data bank with six month follow-up. Presents tables and discussion on features used for prediction. Defines four head injured survivor outcome categories as: vegetative state, severe disability, moderate disability, and recovery. Uses independence model for statistical score distribution to show probabilistic predictions in patient outcome. Includes 54 references.

Bricolo, A. Turazzi, S., & Feriotti, G. Prolonged posttraumatic consciousness: Therapeutic assets and liabilities. Journal of Neurosurgery, 1980, 52, 625-634.

Presents study of 135 cases of posttraumatic unconsciousness lasting more than two weeks at one, three, six, and 12 months for outcome projection. Prolonged unconsciousness transition into vegetative state and quality of human life are discussed. Extensive reference list.

Brink, J. D., Imbus, C., & Woo-Sam, J. Physical recovery after closed head trauma in children and adolescents. Journal of Pediatrics, 1980, 97, 721-727.

Reviews study involving 344 head injured patients under 18 years of age in comatose condition for more than 24 hours with follow-up to one year. Uses Ommayas five level classification of consciousness system to assess outcome potential. Three case studies are presented to illustrate three outcome categories of: ambulation independence and self-care, significant limitations, and totally dependent care. Findings show coma length is a significant factor in outcome prediction. Negative outcome indicators are: hypertension, ventricular dilatation, and seizure activity.

Dye, O. A., Milby, J. B., & Saxon, S. A. Effects of early neurological problems following head trauma on subsequent neuropsychological performance. Acta Neurologica Scandinavica, 1979, 59, 10-14.

Authors combine information on mental capacity recovery with neurological indicators to increase validity of indicators for prognostic decisions. Presents study of 48 traumatic head injured concussive type patients. Early neurological problems found to have detrimental effect on subsequent test performance. Results support use of these early indicants to make prognostic decisions.

Forer, S. K., & Miller, L. S. Rehabilitation outcome: Comparative analysis of different patient types. Archives of Physical Medicine and Rehabilitation, 1980, 61, 359-365.

Provides data on 263 patients progress discharged from rehabilitation unit at one year to 19 months post discharge. Areas of eating, dressing, transfers, bladder management, ambulation, cognition, language comprehension and speech, placement, and mortality are studied with appropriate rating. Findings indicate head trauma patients show tendency to move into more restrictive environments following initial discharge placement.

Frowein, R. A., Haar, K. auf der, & Terhaag, D. Assessment of coma reliability of prognosis. Neurosurgical Review, 1980, 3, 67-74.

Coma lasting longer than 24 hours is assessed in 596 head injured patients. Findings reveal a 5% borderline table depending on age of patient. Statistical survival chances dropped below 5% between 5th and 20th coma day for patients over 60 years of age compared to after 20th coma day for patients between 10 and 20 years of age.

Gilchrist, E., & Wilkinson, M. Some factors determining prognosis in young people with severe head injuries. Archives of Neurology, 1979, 36, 355-359.

Compiles findings on 84 head injured patients under 40 years of age that affect long-term prognosis. Findings show treatment length is proportional to patient coma length. Patients in coma for 24 hours to one week require 25 weeks of various hospitalization programs and a two to seven week coma patient requires 47 weeks of treatment. Lengths of occupational therapy treatment are discussed.

Jellinek, H. M., Torkelson, R. M., & Harvey, R. F. Functional abilities and distress levels in brain injured patients at long-term follow up. Archives of Physical Medicine and Rehabilitation, 1982, 63, 160-162.

Discusses long-term follow up study of 40 brain injured clients following discharge from rehabilitation unit in areas of self-care, mobility, living arrangements, communication, recreation/leisure, and education/employment. Findings reveal those who achieve independence in certain functional skills exhibit less distress than dependent clients.

Jennett, B., Snoek, J., Bond, M. R., & Brooks, N. Disability after severe head injury: Observations on the use of the Glasgow Outcome Scale. Journal of Neurology, Neurosurgery, and Psychiatry, 1981, 44, 285-293.

Reviews the four categories of Glasgow Outcome Scale and proposes sub-divisions to allow patient improvement records within categories. Findings from study of 150 conscious head injured survivors reveal fewer improved between six and 12 months than between three and six months post-injury. Mental barriers contribute to social disability rather than neurological problems in most cases. Quality of life of survivors is discussed.

Levin, H. S., Grossman, R. G., Rose, J. E., & Teasdale, G. Long-term neuropsychological outcome of closed head injury. Journal of Neurosurgery, 1979, 50, 412-422.

Presents study of 27 head injured patients who recovered to a testable stage with long-term neuropsychological findings. Intellectual functioning, memory functioning, aphasic defects, behavior patterns, and injury severity contribute to determining long-term outcome. Findings show oculovestibular deficit as significantly predictive of prolonged disability and neuropsychological impairment.

Najenson, T., Groswasser, Z., Mendelson, L., & Hackett, P. Rehabilitation outcome of brain damaged patients after severe head injury. International Rehabilitation Medicine, 1980, 2(1), 17-22.

Results of 147 brain injured cases are tabulated according to progress through rehabilitation to work reintegration levels. Findings reveal multidisciplinary rehabilitation teams' expectations and patients' actual functioning are proportional to extent of injury.

McKinlay, W. W., Brooks, D. N., Bond, D. N., Martinage, D. P., & Marshall, M. M. The short-term outcome of severe blunt head injury as reported by relatives of the injured persons. Journal of Neurology, Neurosurgery, and Psychiatry, 1981, 44, 527-533.

As head injured patients usually lack insight, relatives of 55 severely head injured adults are interviewed at three, six, and 12 months post injury to determine short term outcome. Slowness, tiredness, irritability, and poor memory are most frequent mental changes. Findings show the higher the stress on the relatives, the more the head injured patient has changed, which is the primary concern of the rehabilitation therapists. Level of stress among relatives remained the same during three, six, and 12 month interviews.

Timming, R., Orrison, W. W., & Mikula, J. A. Computerized tomography and rehabilitation outcome after severe head trauma. Archives of Physical Medicine and Rehabilitation, 1982, 63, 154-159.

Presents study of 30 head injured patients who had computerized tomography (CT) and extensive multi-disciplinary rehabilitation program. Findings reveal group with large ventricles on CT scan had least favorable rehabilitation outcome and stayed the longest in rehabilitation unit.

Van Zomeren, A. H., & Deelman, B. G. Long-term recovery of visual reaction time after closed head injury. Journal of Neurology, Neurosurgery, and Psychiatry, 1978, 41, 452-457.

Presents study of recovery curves for simple and choice reaction times of head injured patients during a two year post injury period. Severity of head injury is used as an independent variable. The choice reaction time appears to have value in predicting final outcome.

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